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ABSTRACT

Presented is the hearing to extend and make technical corrections to the National Sea Grant College and Program Act of 1966 as amended. The texts of the bills presented by the Senate (S. 1262) and the House (H.R. 5452) on these matters and the National Science Foundation comments on S. 1262 are included. Among the proposed amendments is the transfer of authority from the "National Science Foundation" to the "Secretary of Commerce." Statements summarize the purpose of the Act, include examples and samples of existing college programs, and present potential programmatic goals which include expansion of international efforts. Discussions among committee members indicate concern over the administration's proposal to freeze money at last year's level which would mean program reduction. Appended are supporting letters, articles, and statements. (MLB)

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NATIONAL SEA GRANT COLLEGE PROGRAM AUTHORIZATION

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON OCEANS AND ATMOSPHERE

OF THE

COMMITTEE ON COMMERCE

AND THE

SUBCOMMITTEE ON EDUCATION

OF THE

COMMITTEE ON LABOR AND PUBLIC WELFARE

UNITED STATES SENATE

NINETY-THIRD CONGRESS

FIRST SESSION

ON

S. 1262 and H.R. 5452

TO EXTEND AND MAKE TECHNICAL CORRECTIONS TO THE NATIONAL SEA GRANT COLLEGE AND PROGRAM ACT OF 1966, AS AMENDED

MAY 30, 1973

Serial No. 93-37

Printed for the use of the Committee on Commerce

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NATIONAL SEA-GRANT COLLEGE PROGRAM AUTHORIZATION

WEDNESDAY, MAY 30, 1973

U.S. SENATE, COMMITTEE ON COMMERCE,
SUBCOMMITTEE ON OCEANS AND ATMOSPHERE, AND
COMMITTEE ON LABOR AND PUBLIC WELFARE,
SUBCOMMITTEE ON EDUCATION,
Washington, D.C.

The subcommittees met, pursuant to notice, at 10:30 a.m. in room 3302, the New Dirksen Building, Hon. Claiborne Pell and Hon. Ernest F. Hollings, chairmen of the subcommittees, presiding.

OPENING STATEMENT BY SENATOR PELL

Senator PELL. This morning the Subcommittee on Education of the Labor and Public Welfare Committee and the Subcommittee on Oceans and Atmosphere of the Senate Commerce Committee will hear testimony on S. 1262 and H.R. 5452, legislation to extend the authorization for the national sea grant college program.

At the outset I wish to express my thanks to my colleague, Senator Hollings, chairman of the Oceans and Atmosphere Subcommittee, for his cooperation in conducting this joint hearing. Joint hearings of this kind are unusual in the Senate and indeed in the Congress. In this instance, I believe a joint hearing serves not only to expedite the business of the Senate, but this joint hearing also can help to strengthen and improve the sea grant college program by focusing on the legislation the combined expertise and knowledge of two subcommittees, each with a distinct interest and concern in our national ocean program.

Again I thank Senator Hollings and the members of his subcommittee for their cooperation.

I should note at the outset of this hearing that I have a particularly strong interest in the national sea grant college program.

I was the author, with Representative Paul Rogers of Florida, of the bill that established the program in 1966, and I have followed its development closely with concern, and I should add, with considerable pride. I believe the wisdom of the Congress in authorizing the program has been amply proven. The sea grant college program in my view has been a catalyst that has welded disparate and sometimes isolated parts of the marine sciences, marine engineering, and political sciences into an effective partnership to solve the difficult and complex problems involved in using and preserving marine resources for the benefit of mankind.

Staff member assigned to this hearing: James P. Walsh.

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I have no great concern about the performance of the sea grant college program—I think its record will speak for itself. Our concern focuses instead on the credibility of the program among the universities, colleges, institutions, and private industries that participate in it.

The sea grant college program is built on relationships among departments of individual institutions, on relationships between institutions, and most critically important, on a continuing relationship with the Federal Government. This network of relationships is seriously endangered if the Federal Government does not fulfill its commitments to the program, and if the reasonable expectations of participating institutions are not fulfilled. This means not only level funding, but expanded funding and expanded growth.

The funding of the Federal Government's share of this program during the past several years, I believe, has tended to undermine the credibility of the program in the eyes of some of the participating institutions. If so, this can have grave consequences for the future effectiveness of the program, and it is a question that I intend to pursue this morning.

I also hope the witnesses this morning will address themselves to a provision of the Senate bill (S. 1262) which I introduced with Senators Hollings, Pastore, and Magnuson, which would authorize a study of the most effective means of providing for a transfer of marine technology to the developing nations of the world. In other words, trying to move into the area of developing an international sea grant college program, somewhat along the lines of our already successful national sea grant college program.

The developing nations of the world have a major stake in the marine resources of the earth. These nations do not, however, possess the technology to share in the development of those resources, and in many cases they do not have the technology to effectively protect those resources. As a result, the efforts of the United States and other technologically advanced nations in ocean research, and in resource conservation and protection, and in law of the sea questions often are viewed with suspicion by the developing countries.

To allay these suspicions, and to provide the basis for a genuine cooperative effort in ocean research, exploration, and use of marine resources, it is important that the developing nations have the necessary technological tools. Technology transfer is a difficult and complex process, but I think it is time to make a start on this difficult task by studying how marine science technology transfer can best be effected. Again, I hope the witnesses this morning will be willing to offer their comments on this subject.

We are particularly honored today by having with us at the hearing all the members of the Sea Grant College panel who are presently meeting in Washington. I am so glad they came up and will be participating in this hearing, seeing the process of legislation, seeing what the intent of the Congress is, and being better able to translate the intent of the Congress into the practical use of research into dollars and cents for the American people, the world's people and also for industry. And in this regard, as some of you may know, I am trying to move the relationship of industry directly with the sea grant program, so they can be guided to the right universities and the right methods to achieve success.

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Without objection, the text of the bills under consideration S. 1262 and H.R. 5452 will be printed in the record.

And I will now defer to my colleague who has got as strong an interest in the affairs of the ocean as I have, Senator Hollings.

OPENING STATEMENT BY SENATOR HOLLINGS

Senator HOLLINGS. Thank you, Mr. Chairman. It is a privilege to join with you as the chairman of the Subcommittee on Oceans and Atmosphere of the Commerce Committee in a hearing for the bills to make corrections to the National Sea Grant College and Program Act of 1966.

In addition to welcoming all of these distinguished witnesses, I think we are both privileged also to have a former colleague, the Congressman from North Carolina, to lean on, who has really been the leader in this oceans field and continues to give leadership.

I wish to express at the outset that we are pleased with the outstanding success of this program and the leadership and direction given to it by our first witness, Dr. White, Administrator, National Oceanic and Atmospheric Administration.

The National Sea Grant College program was transferred to NOAA by the President's Reorganization Plan No. 4 in 1970. The Congress, however, is seriously concerned about a seeming lack of commitment on the part of the executive branch on the sea grant program. The proposed level of funding of $19.5 million for the fiscal year 1974 is actually a setback in our effort to achieve the goal of a national oceans program for the United States—a goal in which the sea grant program plays a major role. The cutback by the Office of Management and Budget is a disappointment, since most of the institutional participants and supporters in Congress had anticipated something on the order of $25 million.

In the authorized level of funding for fiscal 1974, the major cutbacks were inflicted upon the program in the present fiscal year, causing serious disruptions in the existing projects. The level of funding for 1974 means major projects must be curtailed because they contain an unavoidability in protection of the need of additional dollars.

My understanding is some institutions have had to absorb cuts of more than 25 percent. The fact is, the sea grant program in South Carolina got off to a very modest start with $212,800 grant in funds, and had anticipated a much larger level of support in fiscal 1974. We are now told we will be lucky to get the same amount we got last year, and that was only a startup grant. Even with this small amount of money, our State has more than proved the success of the sea grant program with an impressive array of accomplishments and new efforts in the marine field.

Of course, the bills before this committee are authorization legislation and the matter of appropriations is now under consideration in the Appropriations Committee, and we will be taking a close look at the budget for sea grant. I am privileged to be with you this morning to welcome these distinguished witnesses.

[The bills and agency comments follow:]

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93D CONGRESS
1ST SESSION

S. 1262

IN THE SENATE OF THE UNITED STATES

MARCH 15, 1973

Mr. PELL (for himself, Mr. HOLLINGS, Mr. MAGNUSON, and Mr. PASTORE) introduced the following bill; which was read twice and referred jointly, by unanimous consent, to the Committees on Labor and Public Welfare and Commerce

A BILL

To extend and make technical corrections to the National Sea Grant College and Program Act of 1966, as amended.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Sea Grant College and Program Act of 1966, as amended, is further amended as follows:

(1) In section 203(b)(1), insert after "for the fiscal year ending June 30, 1973, not to exceed the sum of $30,000,000," the following: "for the fiscal year ending June 30, 1974, not to exceed the sum of $30,000,000, for the fiscal year ending June 30, 1975, not to exceed the sum of

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$40,000,000, and for the fiscal year ending June 30, 1976, not to exceed the sum of $50,000,000,".

(2) In section 204(a), delete subscript "(1)"; and delete all after "in any such fields", substituting a period therefor.

(3) In section 204(d)(1), after the first sentence insert the following: "The Secretary may grant total payments that exceed such per centum with respect to those programs or portions of programs requested by the Secretary on his own initiative, upon his determination that the requirement for payments of 33⅓ per centum of the cost thereof by the participant would be inequitable relative to the benefits which the participant would receive therefrom. The total amount of payments to be made by the Federal Government under all programs and portions of programs as to which the Secretary shall in any fiscal year exercise his authority under the preceding sentence to reduce or eliminate matching payments by the participant shall not exceed 1 per centum of the funds appropriated under this Act for such fiscal year."

(4) In section 204(i)(3), after "marine resources" insert "and which is so designated by the Secretary".

(5) In section 204(i), add a new definition as follows:

"(5) the term 'vessel' means every description of watercraft or other artificial contrivance used or

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capable of being used as a means of transportation on water but does not include non-self-propelled habitats, buoys, platforms, and other devices or structures used principally for research purposes.".

(6) Amend section 205 to read as follows:

"STUDY OF INTERNATIONAL MARINE TECHNOLOGY TRANSFER

"SEC. 205. (a) The Secretary of Commerce is authorized and directed to undertake, through the National Sea Grant College Program, a study of the means of sharing, through cooperative programs with other nations, the results of marine research useful in the exploration, development, conservation, and management of marine resources.

"(b) In carrying out the study required by subsection (a), the Secretary is authorized, without regard for paragraphs (1) and (3) of section 204(d), to enter into contracts with, and make grants to, institutions, agencies, and organizations described in section 204(c).

"(c) The Secretary shall submit to the President and to the Congress the results and findings of such study, including specific recommendations, not later than June 30, 1974.

"(d) For the purpose of carrying out this section there is authorized to be appropriated not to exceed the sum of $100,000."

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93D CONGRESS
1ST SESSION

H. R. 5452

IN THE HOUSE OF REPRESENTATIVES

MARCH 8, 1973

Mrs. SULLIVAN (for herself, Mr. DOWNING, and Mr. MOSHER) (by request) introduced the following bill; which was referred to the Committee on Merchant Marine and Fisheries

A BILL

To extend and make technical corrections to the National Sea Grant College and Program Act of 1966, as amended.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the National Sea Grant College and Program Act of 1966, as amended, is further amended as follows:

(1) In section 203(b)(1), in the phrase "for each subsequent fiscal year only such sums as the Congress may hereafter specifically authorize by law", delete all after "such sums as" and substitute therefor "may be necessary".

(2) In section 204(a), delete subscript "(1)"; and delete all after "in any such fields", substituting a period therefor.

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(3) In section 204(d)(1), replace the period at the end of the first sentence with a colon, and insert thereafter the following: "*Provided*, That the Secretary may grant total payments that exceed this per centum with respect to those programs or portions of programs requested by the Secretary on his own initiative, upon his determination that the requirement for payments of 33⅓ per centum of the cost thereof by the participant would be inequitable relative to the benefits which the participant would receive therefrom. The total amount of payments to be made by the Federal Government under all programs and portions of programs as to which the Secretary shall in any fiscal year exercise his authority to reduce or eliminate matching payments shall not exceed 1 per centum of the funds appropriated under this Act for such fiscal year."

(4) In section 204(i)(3), after "marine resources" insert "and which is so designated by the Secretary".

(5) In section 204(i), add a new definition as follows:

"(5) the term 'vessel' means every description of water craft or other artificial contrivance used or capable of being used as a means of transportation on water but does not include non-self-propelled habitats, buoys, platforms, and other devices or structures used principally for research purposes.".

(6) Delete section 205.

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(7) Delete "National Science Foundation" and "Foundation", substituting "Secretary of Commerce" and "Secretary", respectively, wherever they appear; and make conforming changes by deleting "its" and substituting "his" wherever appropriate.

(8) In section 204 (g) delete "it" and substitute "the National Science Foundation".

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NATIONAL SCIENCE FOUNDATION,
Washington, D.C., May 14, 1973.

Hon. WARREN G. MAGNUSON,
Chairman, Committee on Commerce,
U.S. Senate,
Washington, D.C.

DEAR MR. CHAIRMAN: This is in response to your letter of April 19, 1973, requesting the comments of the National Science Foundation on S. 1262, a bill to extend and make technical corrections to the National Sea Grant College and Program Act of 1966, as amended.

S. 1262 would extend the National Sea Grant Act of 1966, make certain technical corrections in it, and provide for a study of international marine technology transfer. The original law as enacted in 1966 placed responsibility for the National Sea Grant Program in the National Science Foundation. However, all functions vested in the Foundation were transferred to the National Oceanic and Atmospheric Administration by Reorganization Plan No. 4 of 1970.

Since the Foundation no longer has any responsibility or authority pursuant to the 1966 Act, it defers to the views of the Department of Commerce.

The Office of Management and Budget has advised us that there is no objection to the submission of this report from the viewpoint of the Administration's program.

Sincerely yours,

H. GUYFORD STEVER,
Director.

Senator PELL. Thank you very much. This is a joint hearing and Senator Hollings and I will be alternating questioning the witnesses and the other members of the committee. It is a technique that the Labor and Public Welfare Committee has done with other bills and it has worked out fairly successfully. The first witness is Dr. Robert White, Administrator of NOAA.

STATEMENT OF DR. ROBERT M. WHITE, ADMINISTRATOR OF NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION; ACCOMPANIED BY JAMES BRENNAN, GENERAL COUNSEL

Dr. WHITE. Messrs. Chairmen, it is my pleasure to discuss with you the national sea grant program and its authorizations beyond June 30 as provided in S. 1262.

We are here today because the present authorizing legislation, Public Law 89-688, "The National Sea Grant College and Program Act," expires at the end of this fiscal year. The Department of Commerce and the NOAA recommend without reservation that this needed and highly successful program be continued by enacting the legislation to extend and make several minor changes to the National Sea Grant College and Program Act of 1966, as amended. Needless to say, we are proud of our stewardship of this program since it was assigned to NOAA by the President's Reorganization Plan No. 4 in October 1970.

As you know, the purpose of the national sea grant program is to accelerate national development of marine resources, including their conservation, proper management, and economic utilization. This is to be accomplished through the sponsorship of programs which encompass (1) research applied to real and current problems, (2) adequate training and education of manpower, and (3) transfer of technology and knowledge to the people who need it in a form they can use.

We believe that sea grant is accomplishing its intended purpose. A particularly meaningful measure of sea grant acceptance and success can be realized by the recognition that sea grant projects are being conducted in 25 States, the trust territories, and the District of Colum-

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bia, and that sea grant's $22.3 million in grants are being matched by $14.2 million of State, private, and industry funds. This represents almost 40 percent in matching funds, although only one-third is required. In fact, several State legislatures appropriate matching sea grant funds directly.

In its short lifetime, sea grant has grown to a point where more than 100 institutions have engaged in 720 different projects, some 1,700 scientists and engineers are involved in sea grant activities, some 1,070 students are enrolled in its programs, and more than 100 companies are affiliated with sea grant. Since its inception almost 6 years ago, sea grant growth has been sustained and carefully planned. Starting with a modest budget of $5 million in fiscal year 1968, it reached $9.6 million in fiscal year 1970 and almost $19.5 million in fiscal year 1973. Two years ago a major milestone was reached with the designation of the first four sea grant colleges, while two more were added this year. Several others will be eligible for designation this year.

During this period, certain principles and practices have proven successful and have been accepted. Significantly, these principles which guide sea grant have been worked out jointly with the universities, providing for a true partnership among the Federal, State, and local governments, the universities, and participating industries. This clearly was the intent of the Congress in establishing sea grant as a matching fund program.

In developing and managing marine resources, solving environmental problems, and transferring technology, the sea grant concept takes on a long-range meaning far greater than its marine mission or a project at a university. We believe that it is the kind of program our Nation needs to help maintain its worldwide superior economic and technological position.

The sea grant approach to fulfill its purpose starts with the view that the Nation's ocean-related problems of resource development and management are an amalgam of scientific, technological, social, and political problems and reflect the complexity of our society. The marine problems which we address are recognized as but a part of emerging national problems such as dealing with the Nation's energy needs or for arresting environmental deterioration. We recognize that to deal with problems of such complexity, that is to develop our resources, to revitalize stagnant industries, and to properly manage our coastal zone, demands attack on all fronts by cadres of well-trained and motivated individuals, with access to adequate facilities and the support necessary to enable them to generate the knowledge and the technology required as a basis for national action. The national sea grant program provides such a forum.

We seek to do many things through our sea grant program. We seek to develop the growing field of aquaculture and its potential for creating new self-sustaining food industries. Scientists from sea grant institutions have joined with the National Marine Fisheries Service to plan for the implementation of a coordinated national effort.

We seek through the sea grant program to provide a means for the transfer of technology to those who earn their living from the sea. To this end, NOAA has launched a marine advisory service combining the expertise of all NOAA components, including the National Marine Fishery Service, sea grant, the National Ocean Survey, and the Environmental Data Service.

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We have placed responsibility for managing NOAA's marine advisory service in sea grant. During the interval since testifying before the House, we have examined the advisory service in 18 States on the Atlantic, Pacific, Gulf of Mexico, and the Great Lakes. We now have a nationwide network with points of contact in each of the 30 coastal and Great Lakes States. Progress and results have been quick in coming. For example, the marinas industry in Rhode Island asked and received from our advisory program a study of the ecological effects of marinas which show that properly designed and operated marinas should have no adverse effect on the environment. The advisory service in Virginia acting through the Virginia Institute of Marine Science has solved a commercial seafood problem dealing with oyster discoloration. Oysters were turning up pink. We were able to show that the color was not indicative of damaged quality. The Marine Advisory Service has begun to work with minority youth in New York City. In the Great Lakes the advisory service is providing quick-response technical assistance to help with the problems posed by unprecedented high water. I could go on with many more examples.

We seek through the sea grant program to help provide the understanding of the environmental impact of man's activities upon the oceans. For example, we are planning a New England offshore mining environmental study that will assess the environmental impact of offshore sand and gravel mining which is a prerequisite to expanding a marine mining industry. This program resulted from the initiative of sea grant. We have also recently completed our Florida aquanaut research expedition—Project Flare—the objective of which was to study the effects of pollution on reef ecology. This project also was stimulated originally by sea grant.

We seek through the sea grant program to provide the knowledge of the processes in the coastal zone which is essential to its management. The sea grant focus on local and regional problems will assist States in this area.

At a national level, sea grant is beginning to play a more vital role, particularly as its research and technological capabilities become better recognized. Sea grant provides model coastal zone management legislation for the States, conducts baseline studies for national, regional, and State monitoring of environmental health, and has been instrumental in delineating and understanding eutrophication problems in the Great Lakes.

An outstanding example of the contribution that the sea grant network can make to national problems is its contribution to the deepwater port issue. The Council on Environment Quality recently requested NOAA which turned to sea grant, to conduct a study and analysis of the pollution-related problems which might be generated by deep draft tankers and offshore terminals, as well as the availability of adequate port facilities in the United States. The sea grant institutional network is currently reviewing this problem, and the results should be available in the next few weeks.

As our concerns about the marine environment continue to evolve and are more clearly identified, we may well see a new role for the sea grant institutional network—that of dealing with problems which have a heavy element of regionalism. I look forward to sea grant emerging now as a national institutional mechanism with the flexi-

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bility, the dynamism, and capability to assist our Nation in the future in many ways which simply were not possible in the past.

As you have indicated, the next witness will be Bob Abel, the director of our sea grant program, and of course, we owe to him much of the success that this program has enjoyed. I will be very pleased to answer any questions you may have.

Senator PELL. Could Dr. Abel come forward and present his testimony and then Senator Hollings and myself will ask our questions to you both.

STATEMENT OF DR. ROBERT B. ABEL, DIRECTOR, OFFICE OF SEA GRANT PROGRAMS, NOAA, DEPARTMENT OF COMMERCE

Dr. ABEL. Thank you, Mr. Chairman, Messrs. Chairmen, it is a great pleasure to be able to come before you again to discuss the national sea grant program, which, as you know, is now in its 7th year, its 6th actual year of operation. In this regard, I might mention that this program has been rendered easy to operate owing to the farsightedness of the Pell-Rogers act, which after 7 years of existence, we find to be as viable as the day it was handed to the executive branch of the Government.

I have prepared testimony with me. In the interest of time, subject to your agreement, I would like to talk of it rather than from it and then submit it for the record.

Senator PELL. It is being included in the record in any case.

Dr. ABEL. Thank you, Mr. Chairman. Naturally we have been most gratified by the end products and services of our program. During the first half decade of its operation, we were of course concerned with developing the mechanics of the program, to satisfy the terms of its founding act. Now after a half-decade, we must naturally be concerned more with the benefits which have been derived from the act's usage to date. They will also serve, of course, as guidelines for its future implementation. It is with considerable pride in the institutions participating in sea grant program that I state that we have documented many of these recommendations and have compiled them into a report. Accordingly, rather than simply recite a list of these benefits and accomplishments, I would like to submit the report for the record with your concurrence.

Senator PELL. OK.[1]

Dr. ABEL. This report and the feats described therein cover an extremely broad range of functional areas which of course correspond to those laid out in the Pell-Rogers act itself. They concern marine resources, et cetera, as well as the social science aspects of the act. They cover the three principal thrusts of the act—education, advisory services, and research and development. We in the sea grant office give considerable credit for these accomplishments to some of the techniques that the member institutions have themselves wrought. We are especially proud of the so called "institutional technique which has enabled our sea grant directors and the various colleges and universities receiving institutional support to develop consortiums, not only within departments of universities, but among universities and colleges, including segments of industry, State agencies, and private foundations.

We are quite taken with this aspect of the act's development and are most encouraged by the way it has proceeded through this half

[1] See p. 33.

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decade. This technique has also fostered and encouraged interdisciplinary research, development, and education, and while the word "interdisciplinary" is commonly used today, at the time the program started it was unheralded.

This leads me to mention an issue which has become concerned with the act's implementation during the last couple of years. It refers to the concept of block funding. It would seem, at least superficially, that the sea grant method is to give a university a pocket of money with the admonition, "Go ye forth and spend it." In fact I want to state clearly for the record, that quite the opposite is true. Every proposal we get from a university or consortia of universities has clearly described the individual projects composing that proposal. Even more stringently, we require that there be a marked degree of coherence among all the projects, which must nucleate around principle themes. If anything therefore, rather than allowing a block-funding concept to creep into the sea grant mechanism, we are as careful as possible about admitting individual projects into the program. Their admission depends on the central theme to which the university program is directed.

We are particularly proud of the manner in which unified programs have developed in the major coastal States which had originally been involved in the program. These include such as California, New York, and Florida, where a great number of universities are allied in the program. In some States, universities have allied even at the program's start: South Carolina comes to mind as a strong example, wherein a half dozen universities and State instrumentalities allied from the beginning of the development of their first proposal.

We were encouraged last year when the States of Mississippi and Alabama allied in common cause, becoming the first bi-State complex.

The emergence of the Coastal Zone Act last year gave new dimension and emphasis to the sea grant program. As you know from previous hearings, the sea grant program was directed with emphasis to the coastal zone, because we believed that is where the action was. The Coastal Zoning Act and its implementation in NOAA (by Dr. White) by creation of the Coastal Zone Office, has allowed new direction to the program, because an additional vehicle translates research into sales, so to speak.

The Pell Rogers Act very clearly specified that the sea grant program should affiliate with as many other public instrumentalities as possible. We have striven to cooperate as closely as possible with other Federal agencies and with State agencies. Of course, the matching funds provisions of the program encourage this. To this end we have, at Dr. White's direction, turned out two reports—one discussing our interrelationships with the other Federal agencies, and the other, in a parallel vein, with the State agencies with whom our sea grantees are affiliated. With your permission I would like to submit these also for the record.[1]

At the time of the last hearing before this body, the advisory function had been the slowest of the three thrusts to get off the ground. There was, of course, good reason for this, as I related at the time. It related to the universities' traditional comfort with education and research and the propelling of these universities into the marine extension service technique which was new technologically and organizationally and which thus presented certain problems.

[1] See p. 58.

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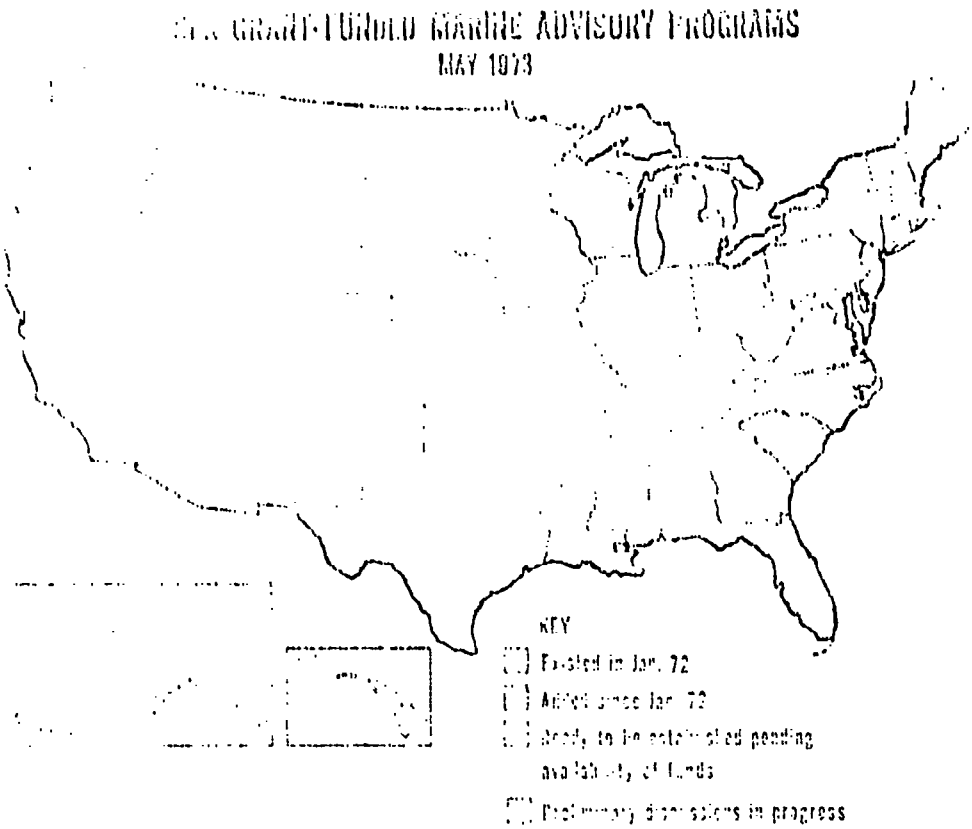
It makes us all the happier, therefore, to be able to relate that this sector of our program is now proceeding with great dispatch, owing very largely to the catalysis that Dr. White provided in declaring that the advisory function was a responsibility of all of NOAA. Therefore, all of the major components of the NOAA are now participants in the marine advisory service, for which Dr. White has given sea grant leadership and implementation responsibility.

To accomplish this, we borrowed Dr. Pluedin from Oregon State University in early 1972 to start the program and then last December, Dr. White's assistant, Howard Eckles, also joined us. Mr. Eckles is now in charge of the sea grant advisory service program and operates also as the NOAA coordinator for marine advisory programs.

At this point, 21 States have fully developed advisory service programs. The other nine of the coastal and lakeside States are in the process of forming such programs. So I think in the very near future we will be able to report with satisfaction, strong ongoing programs in all of the States with aquatic interests.

At this point, approximately 100 people are involved full time in advisory services, respecting all aspects of sea grant endeavor. My staff has prepared a map showing the locations and status of these advisory services, and with your permission, I would also like to submit that for the record. The staff has prepared a series of regional briefings to inform local advisory programs about the resources available to them from sea grant and NOAA. They also have plans underway for coordinating publication efforts, and are developing a system for evaluating the advisory services process itself.

[The map follows:]



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Dr. Auer. In all of this, emphasis must be on local initiative. We believe this to be the essential sense of the act and it has provided an impetus to all of our activities which we couldn't have attained otherwise. We believe this is how we have obtained necessary cooperation of the State and local agencies.

With respect to the amendments before you, the matter of definition of vessels relates to implementing the act, wherein we might want to use resources such as planes and habitats. They might otherwise be denied to us by perhaps an overly liberal interpretation of the word "vessel." As you know, we are not supposed to fund either the purchase or rental of vessels. We suggest the matching funds waiver to give more emphasis to local initiative.

As I discussed a few moments ago, it is our intent in implementing a large sea grant network, and in establishing sea grant colleagues, to allow them as much as possible to share in managing the program itself. We have encouraged Texas A. & M., for instance, to access and publish a catalogue of all of the sea grant reports on an up-to-date basis. We have asked the University of Rhode Island to maintain the National Sea Grant Depository containing the records for all involved in the sea grant program.

We believe these efforts to be in the national interest, rather than strictly for local benefit, or that of the specific university involved. We believe, therefore, it might not be completely fair to ask that the particular grantee contribute the matching funds as well. So we have asked for relief up to, but no more than, 1 percent of our total budget to be able to fund these kinds of operations. The rest of the amendments are technical in nature; they relate to the transfer of sea grant programs from the National Science Foundation to the NOAA.

That brings me up to the final paragraph discussed by Chairman Pell earlier this morning, relating to a sort of internationalization of the sea grant program. As you know, gentlemen, I also serve as the Chairman of the American delegation to the Working Group on Education and Training of the Intergovernmental Oceanographic Commission. As such, I have more than a passing interest in education and training in marine science. Serving on this Working Group allows me close and direct association with persons from other countries with similar concerns. They would be in effect, the collaborators in and beneficiaries of projects implied by that particular paragraph, especially if it should eventually be developed into a true International Sea Grant Program.

I might relate, in this context, that considerable interest has been evinced by other nations in our sea grant program through conversations and correspondence. The United Kingdom, France, Soviet Union, Mexico, and Italy might be cited in this regard. I believe several major nations are now considering the possibilities of establishing something at least vaguely like sea grant, they might eventually emulate the Pell-Rogers Act.

Naturally, under the present conditions of very tight funding, mentioned by both of your Chairmen, we must emphasize domestic issues and programs we have already espoused. The study itself, is the plan to explore without necessarily, implementing these international possibilities and naturally I would be more inclined to favor it--perhaps at some later date. I want to thank you for your kind attention and will be happy to answer your questions.

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Senator PELL. Senator Hollings?

Senator HOLLINGS. I will start with Dr. Abel. You were brought over from the National Science Foundation to NOAA with Dr. White. Has Dr. White given you the visibility, the attention that you think the sea grant program should have?

I want to make sure that the sea grant program has not been damaged in any way. How do you feel about it? Are you happy there or would you like to get back to the National Science Foundation?

Dr. ABEL. Senator Hollings, that happens to be a very easy question to answer in this particular instance. I think that Dr. White has given sea grant the maximum amount of visibility he possibly can. As you know, sea grant in NOAA has been elevated at least one step, hierarchially speaking. This in itself has given us more visibility.

Senator HOLLINGS. How about appropriations?

Dr. ABEL. As concrete evidence I would like to cite the fact that while in the last 6 months the program, as both of you have mentioned, has been adversely affected by tight funding, a number of additional contributors have joined the program who had not previously contributed to sea grant. For instance, last week the Michigan State Legislature passed its first appropration specifically assigned to sea grant. The Texas State Legislature this week has added significantly to its sea grant appropriation. I believe this to be evidence that the program in NOAA is viewed with increasing approbation in many sectors.

Senator HOLLINGS. How many States actually appropriated funds for sea grant?

Dr. ABEL. My guess is 10 States actually appropriate money specifically for the program.

Senator HOLLINGS. When you talk about the visibility, well—let's get to the real problem, the money itself. He gives you all that visibility, but cuts you back with money. Is he going to start issuing you Coast and Geodetic uniforms?

Dr. ABEL. So far each year we have been in NOAA, the sea grant program has received every cent from Dr. White, at his level, that it asked for. In the budgetary processes within NOAA itself, we have complete budgetary integrity. Respecting beyond NOAA, I have to pass the buck to my boss.

Senator HOLLINGS. You were forced to call your sea grant institutions and advise them that they would be unable to spend the letters of credit already extended to them by your office and that the universities would have to absorb the expenses of their programs for quite some time. Can you explain that?

Dr. ABEL. Yes; I can. What we asked for and what was in every case agreed to by the grantee wherever administratively possible, was to lend the program money until July 1, to enable us to keep within rather difficult expenditure ceilings. I am speaking of cash outlays. I believe this was occasioned by restrictions placed on Dr. White which he might be better able to speak to.

Dr. WHITE. Yes; this stems from the President's desire to keep the spending levels down. This means the actual outlay of funds this fiscal year to the $250 billion level and the $268 billion in fiscal 1974. In that process, each organization of the Federal Government is given a quota of a number of dollars which it can outlay. The quota, as it has been

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for many other organizations, is tight. In order for us therefore, to meet the outlay ceilings which were placed upon us, we have had to take a variety of steps to prevent the funds which would exceed this limitation and the restrictions that we have here at sea grant are just one of the steps we have taken to try to keep it in the outlay ceiling.

Senator HOLLINGS. If it was cut then it was cut at OMB and not at your level?

Dr. WHITE. The outlay numbers that we have to work with come down to us and we are directed to keep within that.

Senator HOLLINGS. They give you a figure? How do they arrive at a figure? Rather than the normal budgetary process of you preparing your needs and coming back up through the Assistant Secretary to the Secretary and then on to the White House and OMB, are you telling me that ahead of time they call down and say, bam, this is the level that you should request?

Dr. WHITE. No; it is a system in which there is considerable interaction between the Department and OMB. We initially go forward with our proposals, as to what we think our programs need. Obviously we look at our programs within the context of our responsibility. As it goes from the Department to the Office of Management of Budget, they have the responsibility of looking at it across the Government as a whole. They have fiscal constraints that they have to meet. And, therefore, they have to make decisions. Now these decisions that they make sometimes agree with our proposals and sometimes they do not. But through the budgetary process, there is an interaction between the Department and the OMB.

Senator HOLLINGS. Did Mr. Ash consult with you on this level?

Dr. WHITE. No; I have not consulted with Mr. Ash.

Senator HOLLINGS. We wouldn't have had you in the first place, you know, if we had followed Mr. Ash. I have a feeling we have a continuing war within the administration. You quite well remember, Dr. White, when it was Mr. Ash that said there should not be any NOAA. Then he embarrassed Dr. Wakeland himself and all the way down the line, and when it was about to hit the skids, we went through a different group who got the President's ear and he promulgated the Reorganization Plan No. 4. And what I am wondering—is that antipathy and resistance and opposition still within the White House? It seems like our crowd is now mostly under indictment or they only can talk to their lawyers. And I don't know what to do about it. This is factual. I am not being cute. I just don't think you are getting the proper attention over there, and I am wondering who to talk to about it. I know I can't talk to Mr. Ash.

Dr. WHITE. Well, Mr. Chairman, there are various points in the system, of course, with whom you can discuss this problem. I am sure you have discussed it with many of them. But I truly don't have any advice or suggestions.

Senator HOLLINGS. Like Dr. Abel was talking about the coastal zone. You mentioned it yourself. The level there, I think they approved a transfer of $250,000. So we had it authorized. Up in the millions. You put all the various authorizations and it totaled approximately around $48 million going into coastal research and preparation—the grants themselves and the administration and what-have-you.

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Now, as I understand it, sea grant provides model coastal zone management legislation for the States, but there is only $250,000 in there. Isn't that correct?

Dr. WHITE. I think I should clarify that. The $250,000, Mr. Chairman, is money we have programed from other parts of NOAA, not sea grant program, to provide the necessary planning activities to begin the implementation of the coastal zone management. Now the coastal zone model legislation that we are referring to in this testimony is a work that has been done by sea grant institutions, working in conjunction with their State governments, or other bodies in the State to draft something that could serve as the basis for legislation at the State level. Model legislation would assist the States to participate in the coastal zone plan. This is part of the general charter of the sea grant program and is a kind of activity that has been going on for some time in that program.

Senator HOLLINGS. What would you say is wrong with the sea grant program? Or where have you ever obtained criticism or ideas or suggestions? For example, the National Avisory Committee on Oceans and Atmosphere—has that advisory committee suggested cutbacks or restrictions on the sea grant program or they have asked for an enlargement? I am trying to find out wherein would be the basis and merit for the cut.

Dr. WHITE. No. Specifically, the National Advisory Committee on Oceans and Atmosphere did in its last report, address the sea grant effort. In raising the question Senator Pell has addressed in his amendment as to whether there might not be a good vehicle for bringing about closer international relations.

Senator HOLLINGS. The international program, right?

Dr. WHITE. Right. But they have not addressed specifically the sea grant program. You asked me the question, what is wrong with the sea grant program? What needs to be done? I certainly think that by and large this is one of the most successful programs I have been associated with. Now how does one judge success? One judges success by taking the legislation which authorizes the program, the policies which it establishes, and then measures what has actually been achieved in the program. And as Dr. Abel indicated, when measured against the charge in this legislation, it has been greatly successful. We can cite many examples of achievements of the program and benefits derived from it. The program has not expanded as rapidly as the Congress originally visualized in terms of its authorizations. Now this arises, as it has for many other programs, because of an overriding need to hold spending in check. It is a disappointment to all of us connected with the program that it has not moved ahead as rapidly as we would have liked. But in terms of the achievements it has made with the money it has had, I think the record shows it has been outstanding.

Senator HOLLINGS. So the main problem has been the money?

Dr. WHITE. Yes; but I would like to reiterate the fact that this program is not funded to its full level, because we believe in the administration, that there is a need to keep spending down and even some of the most worthy programs have to tighten their belt to meet this overriding national objective.

Senator HOLLINGS. Comment for us, please, on the increases to the sea grant authorizations over on the House side and the present level

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of $25 million in fiscal 1974, $40 million for fiscal 1975, and $50 million for fiscal year 1976. Is the administration opposed or in support of this level of authorization?

Dr. WHITE. The administration's position, Mr. Chairman, is that we would prefer an open authorization rather than a specific number in the authorizing legislation. This is——

Senator HOLLINGS. Open authorization?

Dr. WHITE. Yes. Such funds can be appropriated as would be required to carry out the purposes of the act. That kind of phraseology.

Senator HOLLINGS. If we gave the OMB crowd that kind of language, I doubt if you would get your pay by the end of the year. You know you couldn't get anywhere with that kind of discretionary wording.

Dr. WHITE. This is a general view being taken by the administration on many of the acts that it is supporting. And to get to the question as to the numbers that are in the House version of the act——

Senator HOLLINGS. Yes.

Dr. WHITE. I think one can only say that those are not unreasonable numbers and I would make the extrapolation in the following way—and I don't base this on any numbers that I have—but if one ultimately visualizes that we will have a large number of sea grant colleges and institutions and that the system today is not fully developed in the States, then the kind of numbers that are indicated in the House report are not out of line.

Senator HOLLINGS. Would you care to comment, Dr. White, on any other changes in the House-passed bill?

Dr. WHITE. Let's see. The changes in the House-passed bill. Excuse me. We support all the House-passed amendments, Mr. Chairman.

Senator HOLLINGS. Then if my distinguished colleague could indulge me one other question, Dr. Abel, I wanted to ask you on the program now underway in South Carolina, can you give me your assessment of its future potential?

Dr. ABEL. Yes, sir. As I mentioned earlier, the program in South Carolina was distinguished from the start by the degree to which the universities allied so quickly. In fact, I might state for the record that it was the fastest grant processing time in the history of the program. It was made possible when the deans and vice presidents of all the universities involved—I will enumerate: Clemson, University of South Carolina, Medical College of South Carolina, Citadel, and Charleston College—sat around a table and inside of 3 hours with Hal Goodwin, my partner, and Charles Miller, our financial officer, actually evolved the entire program including matching fund assignments, with every project spelled out, and all of the overhead and incidential charges specified. It was overwhelming evidence of interuniversity cooperation.

The program at the time, as you mentioned, was given $212,500. As you said, this was a start-grant. The members of our panel who were with us at the time—I might mention Dr. Spilhaus, for instance, who is in the audience—had commented very favorably, not only with respect to the program that were proposed for starting, but as to the future that was predictable, judging from the degree of cooperation and participation at the time. Depending, as Dr. White has said, on the growth of our program itself, I would prognosticate a very good future for that program in South Carolina. But again, I must emphasize that we confront initial financial constraints.

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Senator HOLLINGS. Thank you very much, Dr. White and Dr. Abel. And thank you, Senator Pell.

Senator PELL. Senator Stevens?

Senator STEVENS. Thank you very much, Mr. Chairman. Dr. White, what is the hard figure, as far as the increase in cost that you face down there brought about by salary increases and whatnot on the basis of the next fiscal year - 1974 over 1973?

Dr. WHITE. Senator Stevens, if you are asking that in regard to NOAA as a whole?

Senator STEVENS. Yes.

Dr. WHITE. I believe it is of the order of $10 million that would be necessary for us to keep up with salary increases and increased cost of communications. General increases in cost.

Senator STEVENS. Relatively what percent would that be? 5, 6 percent?

Dr. WHITE. Oh, it would be on the order of—$10 million on the basis of $350 million, let us say. So that is about—what—1 percent would be 3½. In the order of 4 percent.

Senator STEVENS. As I understand it, Congress and not the President, set a limit of $268 billion and the President requested $268.9, as I recall. Within that limit, tell me this. If we put figures in this bill, is that going to be a commitment in your opinion to the sea grant people? Are they going to read it like the Youth Corps people did, when the Congress passed last year a bill saying we could provide $30 million for the Youth Corps and then turned around and gave them $10 million?

Is that going to lead to people making plans for money they are not going to get?

Dr. WHITE. This is one of the reasons the administration is seeking an open authorization, Senator. It is this kind of attitude toward authorization numbers that can lead to disappointment and unhappiness. Authorization figures are an indication of what Congress feels the program ought to be funded at.

What happens through the appropriations process often comes out with different numbers.

Senator STEVENS. My colleague and I are on the Appropriations Committee, and we have got some distinguished former Members of Congress working with you in this regard. As I see the situation now, we have an uncontrollable increase somewhere near $20 billion and we are asked to hold the level to $268 billion. If we do this, that means someone is going to get cut. Not only cut over last year's appropriations, but cut over last year's spending level, which is $250 billion. With an increase in the national debt of some $3 to $4 billion, increases across the board in the cost of living, and uncontrollable cost in the area of welfare, it seems to me that the whole problem is where is the money going to be put? Now if you had an open-ended authorization, this is the unfair question I have been leading to - what would you ask for the next year?

Dr. WHITE. I can tell you, Senator, what has been asked by the Department of Commerce in the past 2 years, to give you an indication of what is requested for the program. In 1973 the Department of Commerce requested, I believe—and I have to check these numbers for the record, sir—$30 million for the sea grant program in 1973 and I

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believe we requested $25 million for the sea grant program in 1974. This is a Departmental request. In other words, this is a request which emanated from the Department of Commerce, not just the NOAA, to the OMB. This, I think, gives you some idea of how we felt about the sea grant effort. I just can't answer the——

Senator STEVENS. In other words, the limitation in this bill of $30 million would actually restrict you from asking for the amount you asked for for the last time? I mean for 1 year at least?

Dr. WHITE. No; we, of course, kept quite within the authorization of the previous 3 years, which provided authorization of $30 million in 1973.

Senator STEVENS. As I understand, you said you were going to ask for $37 million?

Dr. WHITE. Sorry; $30 million in 1973 and 25 in 1974.

Senator STEVENS. I beg your pardon. Now, if there is an open-ended authorization, would you have any greater flexibility within NOAA in regard to programs such as sea grant?

Dr. WHITE. No; it wouldn't change the flexibility within NOAA at all. The amount of money we get each year is requested each year. What we receive through the appropriations process is what we have available to us. The restrictions we may receive through the appropriations process also serve as guidelines to us. To this date, those restrictions have not been other than the normal ones of not transferring money between appropriations and things of that nature.

Senator STEVENS. Let me ask this, Dr. Abel. I don't want to belabor this, but I read your statement and I seem to have the impression, and I hope that I am wrong, that there is not enough sea grant activity related to the basic programs of undergraduate education. Is that an improper impression?

Dr. ABEL. Very little undergraduate education is sponsored under the Pell-Rogers Act. What there is relates to technician training in 2-year community junior colleges and 4-year undergraduate engineering curriculums leading to the bachelor's degree in ocean engineering. I should emphasize that sea grant does not sponsor education with respect to the fundamental sciences, for example, of marine biology or physical oceanography, et cetera. We try to maintain our educational program in parallel balance with the research program; thus all our sponsorship relates to engineering, et cetera.

Senator STEVENS. I am under the impression that in the agriculture field, the Department of Agriculture does a great deal more to assist the farmers to keep up with changes in technology and scientific developments than NOAA has been able to do with the fishing industry to assist the fishermen to take advantage of such developments. Is that a proper impression also?

Dr. ABEL. No, sir. We maintain a marine advisory service in addition to the projects we sponsor under education and training. The marine advisory service, at Dr. White's specific order, is a NOAA-wide program, which is contributed to and participated in by all of the components of NOAA, in addition to sea grant.

Dr. WHITE. If I might comment on that, I think -

Senator STEVENS. Other than providing experience and information, what are you doing about helping to educate our people to deal with these developments - on the basis of the fisherman who wants to

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keep up with the latest developments. How do you convey that to him? I note that it was through educational activity that you were doing that.

Dr. White. If I might comment, Senator, in answer to your first question, I think your impression is correct. I think there is no question that the effort expended by our government in providing agricultural extension service is larger than that we have expended in providing these services for marine activity. This is something we are now seeking to remedy. We are not where we want to be or where we need to be, but we are taking steps to improve our advisory extension services and there are many situations that we know of where more effort is needed and we hope to be able to give this over the next few years and expand this service.

Dr. Abel. I might add to that response, we have at our maximum period sponsored technician training in 15 schools. We are decreasing this area of sea grant sponsorship as we are reducing several other areas, in some cases simply as a matter of available funding and in other instances where the employment situation did not seem to warrant the degree of educational sponsorship provided. After all, we want to be responsive to supply and demand. I would note, however, that we terminated project support at a couple of institutions which received funds for perhaps 2 or 3 years and simply because funding became tight. We are down to about a dozen now, aggregating about a million dollars. I think there might be further decreases, perhaps as much as a half-million dollars over the next year.

Senator Stevens. Thank you very much.

Mr. Chairman, I'm sort of violating the code here a little bit but I'd like to ask Dr. White a question that's not really relevant here. I have been told in recent weeks that the fishing fleet in Alaska is in severe trouble over notices they have received concerning the allocation of fuel, which is based on a concept of a period of the fall quarter of 1971, and the first three quarters of 1972. In this period there has been a substantial upgrading on some of those vessels and we now have the incongruous situation that some of these people are being told that they are going to get their fuel based upon the consumption of the vessels that they have now replaced and that they will not have sufficient fuel to operate this year. It was my understanding that fishing along with agriculture was supposed to get first priority; any food processing was supposed to get first priority in fuel allocations in the event of shortages.

Now, I'd like to ask you if you have been notified of the position of fishing fleets throughout the country and whether we are having a particular situation develop that is not common to the rest of the fleet. What exactly is the situation regarding fuel allocations for our fishing fleet.

I would take it we would all agree we would be better off internationally if we could modernize our fishing fleet and yet it seems to be incongruous that as they modernize they would not get the fuel required for the new equipment.

Dr. White. Over the past half-year as the fuel shortage has grown we have had comments of greater or less urgency for the various parts of the U.S. fishing fleet with regard to the problems they have in getting fuel so it's not a problem that is restricted to Alaska alone.

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Now, I have not heard the details of the particular problem you raised but I will be glad to look into it.

Senator PELL. Please, Dr. White. That is one of the most important questions confronting us and I am working on that. We have got farm tractors in the field at crop time and don't have sufficient gas because they have been habitually supplied by the independent and the independent has been cut off. There are many things.

I was on a pleasure boat ride on Sunday. We can eliminate the pleasure boating and riding that way and certainly substantially, as the Senator pointed out, the need for our fishermen to compete. There is no reason to get them into competition and then cut off their gas and that is something our department should have an input with Secretary Butz and if we have still got the Council on Natural Resources over there: I know you folks are all working together with the Department of Interior.

Senator Stevens and others are sponsoring an allocation fuels bill that will be up on the Senate floor perhaps later this week with that priority being given to the farmers and to the fishermen, but we are going to have to have the facts at hand from NOAA to substantiate our position with the fishermen.

Senator STEVENS. I have a subsidiary question and, again, it's not relevant to the Sea Grant program, but do you have the ability to loan funds to fishing fleets to construct fuel storage facilities? I find one of the difficulties in Alaska is they have been relying upon independent or major distributors that have other customers and as a consequence, they have not built storage in these small fishing villages or in areas where the fishing fleet operates specifically for the fleet and I think if we are going to give them a priority the only way they can protect that priority is to have their own storage to meet a shortage.

We have, I am informed, only 3 days supply in Alaska. If the supply were cut off they could only operate for 3 days and it would seem to be something as vital as the fishing fleet ought to have a reserve that would last through the season at least, and I don't know of any loan funds that are available to those people to build a storage capacity. Are these funds available to you now for that purpose?

Dr. WHITE. There are no loan funds available. Perhaps Mr. Brennan, our general counsel, might be able to comment on that, Jim?

Mr. BRENNAN. Mr. Stevens, I think the answer, as Dr. White stated, as far as NOAA is concerned, we don't have any funds for that type of problem. Maybe other programs in other parts of the Government that I am not aware of, that might be available.

Senator STEVENS. Do you have the authorization to loan them if the funds were available?

Mr. BRENNAN. I don't believe so, sir. The authorities go generally to vessel construction, reconstruction, and repair under the Fishing Fleet Improvement Act.

Senator STEVENS. Well, then, I am going to invite my distinguished colleague from South Carolina to join me in an authorization bill to give you some money because I'm sure the farmers have the authority through the Department of Agriculture to borrow money for not only a storage of fuel but also storage of their produce. You have the authority to loan money for storage, you know, freezer facilities and whatnot, under existing law but I don't think you have the authority — you are saying you don't have the authority for storage of fuel?

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Mr. BRENNAN. I would have to check that, Senator Stevens. My impression is no, at least not in NOAA.

Senator STEVENS. Would you give us an opinion on that——

Mr. BRENNAN. Yes, sir.

Senator STEVENS [continuing]. As soon as you can and we will ask the staff to draw us up a bill if there is a deficiency there.

Thank you very much. I'm sorry to wander from the subject.

Senator PELL. Very important subject indeed.

Senator HOLLINGS. Mr. Chairman, if you will indulge me one more moment, we have a statement from the distinguished Senator from Michigan, Senator Hart. If we can include that at this point plus some other questions both of Dr. White and Dr. Abel, and I want to thank you, Senator Pell, for your indulgence. I have another matter at 12 o'clock. I'm going to have to duck out for a moment and come back later and hope to hear Dr. Atwood and Dr. Knauss.

[The statement follows:]

STATEMENT OF HON. PHILIP A. HART, U.S. SENATOR FROM MICHIGAN

The impact of the Sea Grant program has been substantial and beneficial, particularly in the Great Lakes area, where progress has been made in important projects dealing with water quality, fisheries, port development and marine mineral resources.

As with land grant colleges, the sea grant college program is unusual for government, in that applied research is a primary focus, with attendant commercial possibilities. In fact, the House Report on H.R. 5452 pointed out that some projects have resulted in more than tenfold returns in quantifiable monetary benefits.

Of great concern, then, is the Administration proposal to freeze the money of the Sea Grant Program for Fiscal Year 1974 at last year's level. This in fact will undoubtedly lead to a reduction in programs.

In my own state, the University of Michigan has been active in developing a coherent, environmentally-sound plan for Great Lakes Management, and has been receiving "institutional support" for the last three years, which make it technically eligible for consideration as a sea grant college. Yet, the National Oceanic and Atmospheric Administration indicates that unless the authorizations are increased as provided by the bills under consideration here today, it will not be able to enlarge its sea grant college program.

In fact, the University of Michigan is presently faced with tremendous cutback under the budget as proposed by OMB. In Fiscal Year 1973, its Sea Grant program received $950,000; for Fiscal Year 1974 it is promised only $567,000. Cuts are suggested in research in the areas of environmental impact of thermal discharge, erosion, advanced waste water treatment and governmental design. Some of its 30 projects and 120 faculty and staff members will have to be cut, despite the fact that the program has received substantial state, local and industry support.

Because I believe strongly that the government has a responsibility to future generations of Americans to make an effort to keep the world liveable, and at least to maintain the Great Lakes as a commercial, recreational and aesthetic resource, I hope that the increased authorizations will be accepted, as they were in the House. I recognize that some limits must be placed on government spending; but there are many other programs and subsidies which should be reduced well before this one, which is a laudable effort to help us use our God-given natural resources with an eye towards handing the future as an asset, instead of a headache.

For the record, I would specifically like to ask the NOAA several questions regarding the Sea Grant College Program:

1. How is the Sea Grant College Program administered and what are the practical results of designating a college as such?

2. How many colleges are now eligible for consideration, and what is the rationale for the present position that no new designations will be made.

3. Specifically, is the University of Michigan now eligible for such consideration, and if no budgetary constraints were involved, does its program meet the other criteria for designation?

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4. In making budget cut recommendations, what criteria, if any, were followed by OMB?

Senator PELL. Dr. White, you handle the budget of about $300 million, isn't it, roughly—$350 million, on that order?

Dr. WHITE. No; budget level for 1973 is $336 million and for——

Senator PELL. Now, within the budget under your direction, is there any other program where the cost-benefit ratio to the American taxpayer is higher than this one of the sea grant college?

Dr. WHITE. Well, Mr. Chairman, I wouldn't want to make a statement at this time as to which of the programs in NOAA has a higher cost-benefit ratio. As you know, some of our programs are so vital to the saving of life and property; such as, take the Memorial Day weekend that has just passed. We had the greatest outbreak of tornadoes—180 tornadoes. How do you place a value on the warning services in the face of a tornado or hurricane?

Take the National Marine Fishing Service. For example, our delegation will be going to Copenhagen in just a week and a half, hopefully to get a significant reduction in foreign fishing effort off our shores and the basis for the position of the United States is going to be based upon the scientific work done at Woods Hole Fisheries Laboratory. If we are successful in achieving a major reduction in foreign fishing effort off our shores how do you judge the benefits of our expenditure for the research in that laboratory in terms of the reduction of the foreign fishing effort?

So, it's a very difficult question you ask. I like to think, Mr. Chairman, that all of the programs of NOAA have very high benefit-to-cost ratio. We like to think our programs, all of them, are first class.

Senator PELL. Going back to the original premise of the sea grant college program, the purpose was concentrating on applied research, moving the research that is available in the books of knowledge into the hands of those who can best use it and this is really its purpose. I would think that it would be hard to find a more direct relationship.

Another question along this same line addressed more to Dr. Abel is what relationships do you have directly with commerce? How much of your programs are done in cooperation with private industries as opposed to the universities? Would it be about a 90-to-10 or 80-to-20, or roughly what ratio?

Dr. ABEL. Mr. Chairman, there are approximately 98—let's say just under 100 industries that have been affiliated with the sea grant program in various capacities; some as equal partners with the university, some as contributors of matching funds, others of contributors of equipment, facilities, and personnel. The techniques by which industry affiliates with the sea grant program are quite numerous. The best guess I can make is that perhaps 20 percent of sea grant work is conducted in cooperation with industry, either directly or indirectly through the normal processes by which the universities traditionally work with industries, such as, design and construction of the tools with which they work.

Senator PELL. I am struck by the fact, for instance, maybe with the opening up of China to American views, American travelers, we will be struck the same way. I believe I have heard it said China is now the second or third largest fish producing nation in the world and 85 percent of its fish are farmed and produced within the territorial boundaries of China and this movement toward direct agriculture or what-

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ever we would call it is again something we could do a little more of in sea grant here at home with the high cost of protein food that we see now.

I was wondering if we are moving in that direction at all.

Dr. ABEL. Yes, sir, I agree with the statement. We certainly are moving in that direction, you will find the report of our accomplishments to include several instances of this such as for instance: United Fruit, which built a plant for shrimp farming based on techniques acquired at the University of Miami project:

Ralston Purina, which has inaugurated a separate division based on shrimp food developed in association with Texas A. & M. University;

The Domsea industry, which was started under sea grant and which has gotten off to such a flying start, achieving its first actual produce: that is, the salmon reared to market size in cages. I could go on to discuss these.

We try very hard to translate from research into sales and this is, in fact, our overall guiding principle.

Senator PELL. The reason I am asking this question of you is I realize you have your advisory panel here and I wonder if you would let them know also the views some of us have. This is the direction we want to see you move along into, the direct help to American industry, to American fishermen, and to the American taxpayer directly.

Dr. ABEL. Yes, sir. It's no accident, incidentally, that the panel composition is overbalanced toward industry. I was told at the time the panel started there were more industry participants on the panel than the aggregate of panels advising all the other divisions of the National Science Foundation.

Senator PELL. That would not be difficult to achieve. I congratulate you and hope the trend will continue.

A couple of little specific questions on funding. Would you provide for the record, Dr. Abel, since you have been with it from the very beginning, to appear in the hearing the congressional authorization, appropriation, and actual expenditure for each year since the program started?

Dr. ABEL. Yes; did you want me to——

Senator PELL. Not now. Just for the record after.

[The following information was subsequently received for the record:]

SEA GRANT BUDGET HISTORY

[In millions of dollars]

Fiscal year	Authorization	OSG request	Agency [1] request	President's budget	Appropriation	Actual expenditure
1967	5.0	.....	[2] 1.0	1.0	.....	0
1968	15.0	5.0	[3] 5.0	5.0	5.[illegible]	[illegible].0
1969	6.0	9.0	[4] 6.0	6.0	6.0	6.0
1970	15.0	10.0	[4] 6.0	6.0	[5] 10.0 9.0	9.0
1971	26.0	18.0	13.5	13.5	13.5	13.5
1972	25.0	21.0	21.0	15.0	17.5	17.5
1973	30.0	30.0	30.0	21.2	21.2	[6] 19.5

[1] National Science Foundation, 1967 through 1971.
[2] Request for internal reprogramming, allowed by OMB and the Appropriations Committees.
[3] Original request was for $4,000,000 to which was added one million from 1967.
[4] Agency request originally for $10,000,000, reduced to $6,000,000 when the House cut National Science Foundation budget by 6 percent.
[5] Following the National Science Foundation reduction from $10,000,000 to $6,000,000, the Senate stipulated a minimum appropriation of $10,000,000 for sea grant within NSF. This was reduced to $9,000,000 for practical purposes when the NSF director appropriated $1,000,000 for his own fund.
[6] Appropriation of $21,200,000 was reduced to an expenditure ceiling of $19,500,000 by impounding $1,700,000.

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Senator PELL. Now, for the current fiscal year, we authorized an appropriation of $30 million and the Appropriation Committee appropriated about $21.2 million, if my recollection is correct. Have any of these funds been impounded or are you getting the whole amount?

Dr. WHITE. No; some of those funds have been impounded. The program will spend this year rather than the $21.2 that was appropriated 19-point- 19.5.

Senator PELL. How did you arrive at that figure? Was that out of the direction of the OMB or was that your own idea?

Dr. WHITE. No; it was-- let me say it was arrived at as a result of a process of discussion between ourselves and ----

Senator PELL. Intermixture?

Senator HOLLINGS. Interaction.

Senator PELL. Interaction.

Senator HOLLINGS. Now we have it. You actually got cut out $1.7 million, because I noticed a transfer of some of your funds in the supplemental appropriation. It came out of your NOAA budget and was transferred to other sections in the Department of Commerce. I was trying to hold it up, but they said it couldn't get to sea grant if I did hold it up. So we will talk about that at another hearing, but I wanted to make sure sea grant wasn't cut.

Excuse me, Mr. Chairman.

Senator PELL. Because of its level funding and various costs go up, the result which would be a declining program which might be disheartening to the guys running it, what has been the effect on the various institutions with which you have dealt of this level which is really declining funding? Would you be able to characterize it, Dr. Abel?

Dr. ABEL. Yes, sir, the following: We have had to reduce funding to our institutions as I believe you mentioned earlier, Mr. Chairman, by about a quarter or more.

Second, we made few new grants last year. We will make no new grants this year. Looking ahead to fiscal 1974 it's highly unlikely that we will make any new grants that year either.

The effect on the grantees has been accentuated by the fact that costs of living being what they are, level funding means reduction. In some cases, this is even more harmful than one might at first realize. For instance, the University of Rhode Island has had to contend for the first time with a faculty that has adopted collective bargaining. If I remember correctly, an 18-percent raise has been negotiated over 2 years, which is quite a bit higher than the normal cost-of-living increase assumed for our computation purposes.

Senator PELL. If you would pull out of the air the three programs of which you are proudest in your directorship of the program, what would you choose, Dr. Abel? The greatest impact upon the American public.

Dr. ABEL. As Dr. White has expressed himself with respect to all of the components of NOAA, so might I also express myself with the component members of the sea grant network. Naturally, I would have to say that those universities which have achieved sea grant status did so on merit and I believe that case stands as it has been put on record.

Senator PELL. Maybe you could submit to the record, and don't if it's of any embarrassment, a few, half-dozen or so of the actual

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return to the American taxpayer like the shrimp program in Miami, if just for no other reason so that I can use it in my little speeches for the reason of the sea grant college program. The things which you consider the brightest jewels in your diamond.

Dr. Abel. Yes, sir, we will be happy to.

Senator Pell. Thank you. Now, what is the total amount of money that is requested of you in the last fiscal year, roughly?

Dr. Abel. Requested by the aggregate of grantees?

Senator Pell. Yes. In other words, that you had to turn down. What I am driving at is how much did you have to turn down?

Dr. Abel. Well, Mr. Chairman, in order to avoid the chaos that would result in the aggregate if each of the grantees were to use his respective imagination in forming his proposal, we suggest target figures. The reason we did this this year was that we knew that our funds were restricted. Each of the grantees naturally has inordinate but justifiable pride in his own program. Without guidance, therefore, we would expect each of them to submit a proposal for two or three times the funds available to give them.

That in turn would lead to a very complex and possibly ineffective process of negotiating down to the acceptable half or third of the program.

Now, based on previous years, I would estimate that the aggregate of proposals we would have received would have been at least five times the amount of funds we had available. I must add, also, that those proposals in turn result from considerable internal and external soul-searching by each of the grantees. That is to say, each sea grant college, for instance, has its internal board consisting of deans and department heads who work rather vigorously to present what they believe would be the solidest possible proposal. Further, each of these colleges also has an external advisory group similar to our own, in context, which reviews their proposals before they are submitted to us.

Senator Pell. Do you find any significant overlap of research funding between the sea grant program and the NSF? Specifically, if my recollection is correct, the NSF does not have the matching requirements that you do, although you are requesting that the matching requirements be—you are going to leave them unchanged, but doesn't this mean a man will come to you with a program, you have to turn him down because of the matching requirements, then he goes to NSF where he will get it funded without perhaps less stringent supervision and perhaps be the same programs.

Dr. Abel. The National Science Foundation does conduct programs similar to sea grant; that's true. I would mention—for instance, their RANN program—research applied to national need, for two reasons: First, it's closely allied in nature to sea grant; and second, I would like to point out for the record, at least in its aquatic aspects, it is run very competently. This has enabled us to work very closely together. This has been fortunate for us because in several instances where we simply lacked funding to enable continuance of projects or to inaugurate new projects we felt to be highly meritorious, the Foundation was able to assume the cost.

Senator Pell. Well, as you remember in the basic authorizing act, there is a strict prohibition between bricks, mortar, and vessels. That would not apply to NSF, would it?

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Dr. ABEL. No, sir; it would not.

Senator PELL. So that would be one of the other points of difference here, but you do not feel there is any significant overlap of research funding at this time?

Dr. ABEL. In mission but not in funding; we lack the funds to sponsor new projects. In addition we employ the people who are attached to the RANN program on our site visits. For instance, Dr. Kolf has accompanied us on several visits; he thus has an opportunity to witness sea grant activity firsthand. In turn, my partner, Mr. Alexiou, has participated in National Science Foundation reviews.

Senator PELL. The Senate bill would direct the Commerce Department, through the sea grant program, to study the means of accomplishing effectively the transfer of marine technology to developing nations and as you know, we provide for a hundred thousand dollars for a study which would be completed by June 30, 1974. As I understand it, speaking in your individual capacities, you would have no objection to this amendment?

Dr. ABEL. That is correct.

Senator PELL. Do you think June 30, 1974, is—would give you time enough to do it? We would like to see it done as soon as possible and we figured that a year should be about adequate.

Dr. ABEL. Yes, I think so. With apologies, Mr. Chairman, I haven't given that matter sufficient study. Speaking specifically of what would enter into such a study, my best estimate is it can be done in a year, assuming that certain kinds of information are readily available and that the kinds of people most competent to conduct such a study are available; that is, that they have the time and we have the funds to give them.

Senator PELL. I remember earlier in your testimony you mentioned the technology advancements of Europe may be moving along in the same direction; Germany, I think you mentioned France and Britain, but the thought of the international sea-grant program would be to help the developing nations and as of now, there seems to be some move in this direction in FAO but it seems to be a sort of vacuum here and this is the thought we had that we might move along in that direction. We get the same enthusiasm. In that regard, I think it would once again put the United States in a very inexpensive way into the lead of a cause of general acceptability around the world, which is not always the case today and if we get the same enthusiasm that we got for the original sea-grant college program so brilliantly thought up and sparked by Dr. Spilhaus and law-of-the-sea problems Dr. Alvin Parto [sic] worked up, these kind of minds on the inside and you on the outside, I could see in 5 years from now where the United States would have been responsible for a spark here that could result in many of the food programs of the developing nations around the world with very, very little cost to the American taxpayer.

This is the thought I would like to see this develop into.

We now have—thank you very much, Dr. White and Dr. Abel. I congratulate you on the brilliant programs you have run and incidentally, for the record, how many employees do you have, Dr. White—Dr. Abel, in your office?

Dr. ABEL. There are 20 employees. We also have students on loan in sort of intern- - -

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Senator PELL. No. I mean civil service employees.

Dr. ABEL. Yes, 20 including the clerical.

Senator PELL. Which is a very small amount for a program I think of this scope and this imagination and innovation, so I congratulate you both on your work in this regard and the closeness of your partnership and we are very glad it is going as it is.

[The statement and information requested follows:]

STATEMENT OF DR. ROBERT B. ABEL

Messrs. Chairmen, Members of the Committees, it is a pleasure to report to you on the National Sea Grant Program, which your Committees created over seven years ago. This represents our sixth year of actual operation. During that period, we have adhered to the language and intent of the National Sea Grant Colleges and Program Act of 1966, Public Law 89-688, as amended.

With your permission, Mr. Chairman, I should like this morning to discuss briefly a few major issues relating to events of the last few years and address myself thence directly to S. 1262 and H.R. 5452 which passed the House May 8, 1973.

Naturally, of greatest satisfaction to my colleagues and myself in the Sea Grant Office and possibly of greatest interest to you are the accomplishments that have already taken place in the National Sea Grant Program. They are, however, quite numerous and rather than discuss each one individually, I should like to offer for the record a paper we have prepared entitled "Benefits from the National Sea Grant Program." In this document, we discuss the accomplishments and payoffs that have already resulted from these first years of our Program's operation in aquaculture and fisheries, seafood science and technology, mineral resource development, biomedicinals, engineering and transportation, education and training, socio-economic and legal studies, coastal zone planning and management, pollution and waste disposal, and finally the advisory services which are proving of increasing importance to our whole program.

The first aspect of program management which has concerned us as a planning force in previous years and as a problem area right now relates to the "institutional technique" under which we have been organizing our grantees. From the Program's inception, it was apparent to us that innovative techniques in management would be necessary to take the best advantage of the Act, which was itself highly innovative.

Further, while the word was not used in those days, it seemed to us that the interdisciplinary was a natural mode for the Sea Grant Program. Consequently, it appeared in the Program's best interest to be able to unite divisions, departments, and schools in universities, as well as several universities, industries and State agencies in common cause, wherever such appeared merited. It goes without saying that such organization presented problems not hitherto encountered by the universities, but we were astonished by the alacrity with which they responded and in nearly all cases have operated successfully.

We feel strongly that it is owing to this unusual form of organization and operation that the accomplishments listed in the paper I have offered have actually taken place.

We can readily understand the concern that has been so often expressed at the block funding techniques used by so many agencies in the past. Sea Grant is not a block funding program. We have emphasized the need of reviewing projects individually when lumped under single "institutional" grants and of insisting upon the use of central themes around which these projects must be nucleated. Nonetheless, the semantic barrier has been difficult for us to overcome.

Progress has been especially noteworthy in most States which have traditionally mounted strong and complex programs in marine science and technology, e.g. California, New York, and Florida to name a few. In these States, between half a dozen and two dozen schools and agencies are united in unified Sea Grant programs. In other cases, States themselves have united, such as in the case of Mississippi and Alabama, which have formed a bi-State agreement for the purpose of a stronger Sea Grant Program. We cannot give the Sea Grant Directors in these areas enough credit. They have performed nobly under the Sea Grant Act.

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The second issue I would like to discuss concerns the coastal zone. The timing of the Coastal Zone Management Act of 1972 we feel to be most fortuitous, following the Sea Grant Act by just over half a decade. Because of this particular sequence, the Sea Grant Program recognizing early the merit of emphasizing coastal zone research, went into high gear, and, is now able to contribute significantly to State and Federal coastal zone management efforts. The Sea Grant Program is now one of the most effective instruments that NOAA has for satisfying its coastal zone responsibilities, and we have every expectation of continuing to serve NOAA in this capacity. Several of our grantees have already been designated by their State government as agents of the State in addressing its responsibilities under the terms of the Coastal Zone Management Act.

In accordance with the intent and language of the Sea Grant Act, we have actively and rigorously followed a program of cooperation, coordination, and exchange of information with other departments and agencies of the Federal government engaged in similar missions relating to the development of marine resources. Rather than taking the time of your Committee to discuss details of the steps taken by Sea Grant and the results obtained, I would respectively like to introduce into the record the paper we have prepared on "Working Relationships between the Office of Sea Grant and Other Federal Agencies."

Similarly, since the Sea Grant Program must rely, per statutory requirement, on matching funds, the program is public-oriented and looks primarily to the State University (and hence, the State) for optimum effectiveness. Matching funds are, of course, sought from other sources such as private industry, foundations or other private sources, but such funds are comparatively small. Thus, it was (and remains) essential for Sea Grant to stimulate and maintain close relations with State governments. Results here have exceeded expectations. This is evidenced by the fact that, to date, a total of 30 States plus the District of Columbia, the Trust Territories and the Virgin Islands are numbered among the recipients of Sea Grants. Here again, I would like to introduce into the record another paper, entitled "Relations between Sea Grant Program Activities and State Governments—A Discourse."

Advisory Services are the public service arm of Sea Grant and are crucial to the overall program. Advisory Services help to differentiate Sea Grant from other Federal marine programs. They communicate useful knowledge to marine users and provide a feedback loop to researchers and managers. After all, applied research is of little consequence until its results have been translated into action in the real world; this is the job of Advisory Services.

This key role for Advisory Services was clearly recognized by you who created Sea Grant. Advisory Services have prospered, assisting the marine community in solving its real and difficult problems and making the entire Sea Grant Program even more responsive and relevant. In acknowledgement of Advisory Service success under Sea Grant Dr. White, as NOAA Administrator, has established the NOAA Marine Advisory Service—under the leadership and management of the Office of Sea Grant—to further strengthen this public service function and bring expanded NOAA-wide resources to bear. The last year, in particular, has marked unusual progress; let me review a few of its key events.

In February 1972, I borrowed Dr. Daniel Panshin from Oregon State University, one of the first four Sea Grant Colleges, for 16 months in order to focus attention on advisory services management and development. In February of 1972 Sea Grant had advisory programs in 19 of the 30 coastal and Great Lakes States; only one of the six other NOAA components, the National Marine Fisheries Service, had an organized advisory service office. In December 1972, the NOAA Marine Advisory Service was formally established and Dr. White's assistant, Mr. Howard Eckles, joined the Office of Sea Grant as Program Manager for the NOAA Marine Advisory Service.

Operating under austere circumstances, Mr. Eckles and Dr. Panshin have made substantial progress toward forming a national network of county agents in hi[illegible] working with the sea people. The Central Office has been opened and staffed. Each of the six other NOAA components now has organized national and regional advisory services offices. Two more States have added advisory programs, bringing the total to 21. The pre-existing programs have been measurably strengthened. Another 5 have developed meritorious proposals which need only funding in order to be activated; and in the remaining 4 States, preliminary discussions and planning have already taken place. There are nearly one hundred full-time advisory personnel in the field, concentrating their efforts in such areas as coastal zone management, commercial fishing, marine recreation, seafood

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processing and marketing, and marine science for the general public. Regional orientation briefings have taken place. Planning is well under way for a coordinated publications effort, a training program, and a management planning and evaluation system. I would like to submit for the record a map depicting this program. Throughout, the emphasis has been on decentralization and on building local capabilities and programs. As a result, marine advisory services are becoming more and more effective in helping the individual marine user in his home community on terms most meaningful to him.

Now, addressing myself to the amendments which have been suggested to the Act before you, we have asked for a legislative definition of the word "vessel". This is more of a convenience stark necessity; the multiplicity of various kinds of vehicles used by laboratories in pursuance of marine activities has sometimes made it difficult to distinguish which of these would be legitimate under the wording of the Act and which would be prohibited.

The waiver of the matching fund requirement for up to 1% of the annual budget will permit us to make grants for what would be essentially common services, i.e. services which a grantee would perform for the country and the national office rather than for himself or the region which he normally services. These would in every case be initiated by us rather than proposed by the grantee. Services thus envisioned would include, but not be limited to, the Sea Grant 70's which I have discussed on several occasions before you and a copy of which I would like to offer for the record, the National Sea Grant Depository at the University of Rhode Island, and various management or technical studies of the Sea Grant Program sponsored to benefit the entire marine community.

The rest of the suggested amendments are technical in nature relating to our transfer from the National Science Foundation to the Department of Commerce.

The Bill authored by yourselves, gentlemen, contains a final section which offers an opportunity I welcome, even though our circumstances at the moment do not constitute a very receptive environment for it. I refer, of course, to your recommendation of an exploration of the possibilities of extending the Sea Grant Program beyond our domestic boundaries. I am in wholehearted agreement with the spirit of this recommendation.

In my capacity as Chairman of the U.S. Delegation to the Training Education and Mutual Assistance Working Group of the Intergovernmental Oceanographic Commission, I have become acutely sensitive to needs of other nations to which the Sea Grant concept would be almost uniquely amenable. Further, the Program would serve admirably, in this perspective, as an instrument of American international cooperation.

However our domestic program needs concentration. This forces us to consider international aspects of Sea Grant in a perspective of balance. While we agree that the recommended study should be a prerequisite to expansion of international cooperation, the expansion and the study itself perhaps ought to be deferred because of problems of domestic concern that override the need for the addition of an international mission which would result in diffusion of our resources. We have advised, and will continue to advise our partners in international affairs of the benefits and methods of establishing programs like ours.

It has been a pleasure to discuss Sea Grant with you Gentlemen, who are recognized as its authors. I will be happy to try to answer any questions.

(The following information was referred to on p. 13:)

Benefits From the National Sea Grant Program

Benefits from the National Sea Grant Program take many forms, only a few of which are susceptible to rigorous cost benefit analysis. One reason is that Sea Grant programs around the nation are essentially stimulators and resources, initiating, researching, and suggesting productive actions which are carried out by others - State agencies, industries, private persons, and various kinds of operational groups. More often than not, the identity of Sea Grant as the originator is lost in the application. This is not something to be regretted or changed, and neither the Office of Sea Grant, NOAA, nor the Sea Grant Colleges and institutions have made any effort to follow all Sea Grant-originated ideas and actions to their ultimate application, claiming credit at each step. Instead, the Sea Grant system prefers to see an idea or action launched and then turn its energies to the generation of new concepts and research.

The only time the "multiplier effect" and diffusion of Sea Grant-originated activities pose a problem is when the national program must be justified in terms

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of its cost-effectiveness; it is often impossible to show a one-to-one relationship between funds expended and effects created. At best, only a sampling of results, representing a small fraction of total effort with relatively quick payoff, can be presented in program justifications. The difficulty in relating Sea Grant cause and ultimate effect is not peculiar to this program. To take an historical parallel, it is generally accepted that the Land Grant Colleges were a primary force—perhaps THE primary force—in creating the unmatched quality and productivity of American agriculture; yet, to take any individual component of modern agriculture and trace it to its roots in Land Grant College research is difficult, if not impossible in most cases. Further, how could a cost-benefit ratio have been derived from the funding of a plant chromosome study in 1910 and the development of brand new triploid species of hybrid plants in 1960?

Cost-benefit analysis is further confused by participation of many institutions other than Sea Grant in marine actions. For example: the aquaculture of pan-size salmon has now been demonstrated in the State of Washington, and its economic feasibility determined. One company, Domsea, Inc., already is in business growing salmon in Puget Sound and another company is beginning operations in Maine. More than 15 companies and groups have applied for water leases to the State of Washington for the net culture of individual-portion sized salmon. This was a Sea Grant project—but only in part. The basic applied research was conducted by the National Marine Fisheries Service in Seattle and that research, in turn, was built on years of research by NMFS and its predecessor, BCF; by the Bureau of Sport Fisheries and Wildlife, State fisheries agencies in the Northwest, and university researchers in Washington, Oregon, Alaska, and California. Sea Grant provided funds to bring the NMFS research to pilot scale so that operational and economic feasibility could be determined. A grant was made to Domsea, which contributed nearly double the Sea Grant funds as matching, to prove out the research on a commercial pilot scale. The Office of Sea Grant requested the National Marine Fisheries Service in Seattle to act as project monitor and technical advisor. As a consequence, a new industry is growing, identification as a Sea Grant project has nearly disappeared from public and official view, but the result has been obtained. The matter of credit is academic—except at budget justification time.

Even more difficult to justify in terms of benefits, which nevertheless are very real, is the role of Sea Grant Colleges and Institutions as a unifying force in U.S. ir service areas. For example, Texas A&M Sea Grant College has conducted a wide-ranging series of conferences in coastal zone management, resource management, deep water and offshore ports, and environmental problems of the Gulf Coast, bringing together for the first time State government, State legislators, private business and industry, public service organizations, conservation groups, and representatives of other educational institutions. Conference proceedings and conclusions, widely distributed by Sea Grant advisory services in the State, have provided a common ground for discussion, an assessment of problems and priorities, and the basis for solutions. Establishing communications among diverse and often-conflicting interests has already shown highly productive results; but the positive actions are taken by others and cannot be credited to Sea Grant.

Similarly, the Sea Grant Institutions and Colleges in most States where they exist have taken lead roles in establishing communications on marine problems among various elements of their communities and States. Over the long haul, this may well be the most valuable contribution Sea Grant has made—but it is not susceptible to cost-benefit analysis.

Another result of the Sea Grant Program has been the bringing together of ancient rivals and bitter competitors. Insistence that a good Sea Grant program is a statewide program has brought together in consortia universities that were traditional rivals or even enemies, and has mended the schism between some universities and State agencies. In several States there is now common agreement on priorities and goals, and a concerted effort among once-competitive agencies and universities to achieve the agreed goals. Sea Grant, in two cases, has even served as a unifying force between adjacent States, creating joint actions to solve common problems that previously had been attacked separately and differently. Such benefits are impossible to quantify.

Although there are sometimes specific cases of advisory service activities for which distinct benefits can be claimed, the great mass of advisory activities cannot be reported in terms of benefits achieved. When Oregon State University holds a "town meeting" for working fishermen, and arranges with the Internal Revenue

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Service to discuss taxes with the fishermen, better tax returns may result, the fishermen may keep their accounts better, and the system may work a little more smoothly—but it is not possible to make any claim for results. When the University of Washington Sea Grant Program works with the Association of Fishermen's Wives, chain food stores, and National Marine Fisheries Service to create a series of give-away recipes to help promote the use of fish by housewives, some impact may be assumed, but there are no facilities for measuring actual increase in consumption.

A great deal of Sea Grant effort in all States with Sea Grant Colleges and Institutions has been devoted to assisting the Federal and State agencies responsible for planning and for coastal zone and resource management. Sea Grantees provide information and expert advice, but do not make decisions. In some cases, the advice may be followed; in other cases, the particular manager may for good reasons decide counter to the advice. In the latter case, it can only be said that Sea Grant presented alternative courses of action for the manager's consideration. In either case, the benefit is real but not quantifiable.

Following are some specific cases in which results are identifiable; they are the cases most easily extracted from reports and should be considered only as examples. The Sea Grant system does not have sufficient manpower available so that complete records can be kept or all results followed through to ultimate application and benefit. Together, in the listings, are benefits and results from which benefits may be expected as the results are applied. For convenience, the list is grouped into broad categories, with each item identified by institution and by the Sea Grant classification of the activity.*

I. Aquaculture

In accordance with the language of Public Law 89-688, the Sea Grant Program has stressed aquaculture research. The state of aquaculture still is relatively primitive and a great deal of research is being conducted on such basics as life cycles, nutritional requirements, environmental controls and impact, and problems of disease. Nevertheless, results are mounting as the following samples show:

University of Miami, Aquaculture, Crustacean (Shrimp)

The first handbook on shrimp culture was produced, based on research conducted by Sea Grant scientists who also made substantial use of research results from National Marine Fisheries Service and others. The handbook contains information on cost-effective diets, disease problems, hatchery design, and shrimp life cycles from egg to adult. Since March 1972, 400 copies have been distributed to users, including about 100 to business and industry and with interest in shrimp culture.

The United Fruit Company, which provided some matching funds for the research, used the information to establish an experimental facility in Honduras.

Louisiana State University, Seafood Science and Technology

As part of the continuing search for the most cost-effective food for shrimp and other crustaceans, LSU has developed a water-stable ration of proper size and texture with good acceptability and conversion efficiency by Gulf shrimp.

University of Georgia, Skidaway Institute, Seafood Science and Technology

To the problem of shrimp nutrition, Skidaway Institute has contributed a water-stable pelleted diet which can serve as a basal diet for future nutrition studies at Skidaway and elsewhere.

(Note: Cost-effective foods for aquacultured species is one of the most critical elements in developing viable commercial aquaculture. Sea Grant has sponsored a multi pronged effort in close cooperation with National Marine Fisheries Service to solve the problems for important species. The examples cited indicate good progress, but "best solutions" have not yet been achieved. Private industry is involved in these efforts.)

University of Delaware, Seafood Science and Technology

As part of its aquaculture research program, the University has developed an acceptable blue crab ration with promise for future improvement. Under Sea

*Some activities for which dollar amounts are given are parts of large grants which satisfy the ⅔—⅓ matching requirement, even though the individual activities may not reflect the overall matching ratio.

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Grant Inter-Institutional cooperation, the crab food is being tested on lobsters at the University of California, Davis, and at the Massachusetts State Lobster Hatchery.

TEXAS A&M UNIVERSITY, AQUACULTURE, CRUSTACEAN (SHRIMP)

TAMU has developed demonstration shrimp culture ponds. One pond produced a record yield in 1972 of over 1800 pounds of shrimp per acre. Ponds have been designed to allow harvesting of 95 percent of the crop with less than two man-hours labor.

UNIVERSITY OF CALIFORNIA, DAVIS, AQUACULTURE, CRUSTACEAN (AMERICAN LOBSTER)

Under a fully-coordinated program of lobster aquaculture research, the University of California at Davis has conducted selective breeding experiments, using lobsters from the Massachusetts State Lobster Hatchery, and has selected out breeding stock with rapid growth rate and larger than normal size. Davis, working on close-system culture using artificial sea water for one onset, has designed and tested a fully closed recirculating system for 70 degree sea water. The system is capable of rearing 3,000 lobsters through the first six months of growth.

UNIVERSITY OF RHODE ISLAND, AQUACULTURE, CRUSTACEAN (AMERICAN LOBSTER)

URI's contribution to the lobster culture program is a successful method of mass production of first stage juvenile lobsters in a recirculating sea water system.

WOODS HOLE OCEANOGRAPHIC INSTITUTION, FISHERIES BIOLOGY

Researchers at WHOI, working on chemical communication among lobsters, have found naturally produced lobster substances called pheromones which can trigger mating and eating behavior in American lobsters. This project holds promise for ultimate control of aquacultured lobster behavior, including progression and breeding.

UNIVERSITY OF DELAWARE, AQUACULTURE, MOLLUSCAN

The University has designed and built a prototype of a closed system for mollusean culture and is now testing the system. The project objective is to develop criteria for "oyster and clam factories" in which the full life cycle of the animal is controlled in a closed system from spawning to collection for marketing.

OREGON STATE UNIVERSITY, AQUACULTURE, MOLLUSCAN

OSU developed a hatchery for Pacific oysters in cooperation with Oregon commercial oystermen. Seed oysters are produced in quantity and those not needed for further experiments are distributed to commercial oystermen by the Oregon Cooperative Oyster Marketing Association.

VIRGINIA INSTITUTE OF MARINE SCIENCE, AQUACULTURE, MOLLUSCAN

The State of Virginia suffers from a serious shortage of seed oysters. Under the continuing Sea Grant Program at the Institute (VIMS), an industrial-type system was developed to produce large quantities of oyster seed including methods of producing and feeding culch-free spat. A Virginia-based oyster shucker and processor is now constructing an oyster hatchery on the Chesapeake Bay to provide seed for the farms and oyster beds using the methods developed at VIMS.

VIRGINIA INSTITUTE OF MARINE SCIENCE, SEAFOOD SCIENCE AND TECHNOLOGY AND ADVISORY SERVICE

A widespread outbreak of "pink oysters" in the Chesapeake Bay during late 1970 and early 1971 posed a serious economic threat to the oyster industry of the region. The federal purchasing agency of the U. S. Armed Services rejected shipments of fresh, frozen oysters sent to them by oyster processors. State and Federal agencies cooperated in an attempt to alleviate the problem with the VIMS Sea Grant Advisory Service as an active participant. In February of 1971,

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a letter explaining the cause of the pink coloration and emphasizing the wholesomeness of the oysters was sent to the appropriate officials and a meeting was held in Washington with the Armed Services purchasing agency. As a result of that meeting, the Inspection Division reversed its earlier decision and accepted [illegible] shipments of "pink oysters." The approximate value of oysters initially rejected and then accepted, and subsequent oyster shipments was $500,000. The cost to Sea Grant was $2,830. The benefits derived were the results of a joint effort by several industry, State and Federal entities. The VIMS Sea Grant Advisory Service served a vital role by acting as principal communicator and source of resources.

UNIVERSITY OF MAINE, AQUACULTURE, MOLLUSCAN

Clam, oyster, and scallop aquaculture in Maine depends on adaptation of shellfish seed stocks to Maine waters. There are no commercial seed sources in the State. The University of Maine, focusing on cold water aquaculture, has developed a pilot hatchery which provides both stock for university experimentation and seed for private developmental ventures. Nearly two dozen individuals and companies are cooperating with the University in applying research results to potential commercial aquaculture. One venture, the Callahan Mining Corporation has made a $100,000 investment and hired a former Sea Grant student as project manager to evaluate and use a flooded mining pit as a site for molluscan and salmon culture. The Maine project includes the native oyster, the European plate oyster, and bay scallops.

DOMSEA FARMS, INC., NATIONAL MARINE FISHERIES SERVICE, STATE OF WASHINGTON, AQUACULTURE, FINFISH (SALMON)

As noted in the introduction, the Sea Grant project conducted by Domsea Farms, Inc., under technical program monitoring by National Marine Fisheries Service, was for the purpose of bringing NMFS and other research to commercial pilot scale to determine feasibility as a commercial venture. The project was completed successfully and high quality, individual portion (parr size) salmon were produced and marketed. A full report by Domsea Farms was made and issued and is available to all companies interested in salmon farming. The results already have been applied by the Callahan Mining Company of Maine, mentioned in the previous item. Callahan has harvested its first crop of pen-reared Coho salmon. University of New Hampshire Sea Grantees, working with the State fisheries officials, are working to apply the technique to the waters of Great Bay, New Hampshire. About 15 applications for additional salmon culture in Puget Sound have been filed.

UNIVERSITY OF RHODE ISLAND, AQUACULTURE, FINFISH (SALMON)

Because of legal, environmental, and institutional restrictions on the use of natural areas for aquaculture in many States, Sea Grant has encouraged experimentation in fully closed systems for aquaculture. When successfully developed, such systems could be used anywhere zoning regulations permit, as is the case with any industrial operation. Use of artificial sea water would even make marine culture systems applicable to inland States. Closed system research for mollusc and lobsters was cited previously. The University of Rhode Island is developing closed system salmon culture. About 16,000 Chinook salmon smolts have been reared successfully in high density "silos" and currently are being held for stocking in "grow out facilities" now under construction. The use of antibiotics in salmonid diets has been shown to reduce the toxicity of ammonia in closed systems using intermediate water salinities.

UNIVERSITY OF WASHINGTON, AQUACULTURE, FINFISH (SALMON)

The outstanding scientist in salmonid culture, Dr. Lauren Donaldson of the University of Washington, has been breeding strains of salmon and trout for nearly four decades and Sea Grant has provided partial support for only the last few years, emphasizing salmonid genetics. The special Donaldson strains of super-salmon were used in the Domsea experiment initially and by others. Sea Grant hesitates to place any claim on the very great benefits from Donaldson's life work, but can point with pride to arranging for Donaldson to assist small aquaculturists from Maine and New Hampshire to California. The benefit is the application of Donaldson's wisdom and experience to the initiation of salmon

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aquaculture outside of the Northwest. Donaldson's work at the University of Washington is improving the quality, quantity, and frequency of runs of fish used for stocking public waters.

OREGON STATE UNIVERSITY, AQUACULTURE, FINFISH (SALMON)

Because annual production of salmon in the Northeast Pacific has declined in recent years, the Oregon State University Sea Grant Program undertook to develop new methods of improving the salmon fishery. The route chosen was to develop private hatcheries for Chum salmon for direct release into marine waters. Chum are a valuable food salmon which do not take bait or lures, and hence commercial harvesting is not competitive with the sport fisheries. OSU created a prototype hatchery which led to an advanced hatchery system designed for large-scale production of juvenile salmon with minimum capital investment and operating cost. The 1971 Oregon Legislature, with Sea Grant biologists and lawyers as advisors, passed legislation to allow chum salmon hatcheries to be operated under control of the Oregon Fish Commission on certain small coastal streams. The first private hatchery has begun operation. Projection of actual cash benefits from the hatchery operation must await the return of four-year-old fish to Netarts Bay.

UNIVERSITY OF WISCONSIN, FISHERIES BIOLOGY (SALMON)

Fishery scientists at the University have developed a technique for "imprinting" young migratory anadromous fish such as salmon to artificial chemical odors. The technique makes it possible to use the chemical odors to divert the fish to any desired location. The technique has implications both for aquaculture, as in the case of the Oregon State private hatchery program, and for the public stocking of salmon runs.

OREGON STATE UNIVERSITY, PATHOLOGY OF MARINE ORGANISMS

The University has developed a vaccine which appears to be effective in controlling *Vibrio anguillarum*, a bacterium which causes disease in salmon.

TEXAS A&M, UNIVERSITY OF MARYLAND, AND UNIVERSITY OF WASHINGTON, PATHOLOGY OF MARINE ORGANISMS

Mortality among marine organisms has been the subject of research in many institutions. One of the most widespread classes of bacteria is the *Vibrios*. The species *Vibrio parahaemolyticus* was found by University of Maryland researchers to be present in oysters, blue crabs, and soft-shelled clams. Texas A&M isolated the bacterium from brown shrimp, and work at the University of Washington suggested that oyster mortality on the West Coast was caused by *Vibrio*. The investigations proceeded to define ways of controlling the disease. The findings have application in aquaculture, but it is difficult to envision any method of control that could be applied to marine animals in the natural environment.

Note: Marine colloids, extracted from red and brown seaweeds, have many useful properties as jelling and smoothing agents. The marine colloid industry in the United States is relatively small, but holds the key to many larger industrial applications. These colloids, which are pre-sugar polymers called polysaccharides, are used in foods cosmetics, medications, surgical dressings, paints, abrasive suspensions in industry as fixatives for textile and paper inks, in adhesives and in dairy products. There are more than 500 industrial processes that depend on the colloids. With increasing demand, the natural supply of seaweeds has become inadequate around the world. Sea Grant, with matching funds and provision of services from industry, has supported several seaweed aquaculture projects.

CALIFORNIA INSTITUTE OF TECHNOLOGY, AQUACULTURE, PLANTS

The giant kelp, macrocystis, a brown seaweed, is the principal source of alginates, one of the principal classes of marine colloids. Because of environmental changes of various kinds, caused by human activities on the West Coast, the great kelp forests off California declined and, in a few cases, disappeared entirely. A Sea Grant project at Cal Tech, also supported by State and county agencies and by an industrial firm, identified the probable causes of kelp decline between 1911 and 1960, initiated remedial action now applied by the

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State and industry, and began research into methods of restoring the beds. Techniques were developed for juvenile plant propagation and protection so successfully, that the possibility of planting completely new beds is being explored; some of the old beds have been regenerated by planting techniques and are fast approaching their original size.

UNIVERSITY OF HAWAII, AQUACULTURE, PLANTS

Carrageenan is another major seaweed colloid which is a basic material in many industries. The demand for carrageenan exceeds the dependable natural supply of red seaweeds. In particular, there is a current demand for a seaweed fraction which can best be produced from a species of red alga called *Eucheuma*. This extract, the iota fraction, makes snap-pack desserts and similar processed foods possible. Under Sea Grant support at the University of Hawaii, the production of *Eucheuma* on pilot farms was shown to be economic. A management plan for such farms was developed and washing and drying procedures for improving the yield of carrageenan from *Eucheuma* were perfected. Efforts are being made to extend *Eucheuma* farming, now principally in the Philippines, into American flag territories in the few areas where labor is available and, at the same time, to develop mechanized farming systems more suitable for the U.S. economy.

UNIVERSITY OF SOUTH FLORIDA, AQUACULTURE, PLANTS

Sea Grant investigators have shown that *Eucheuma* can be transplanted from deep, offshore waters where it grows naturally off Florida into shallow waters where farming is possible. Several techniques that may be adaptable to large-scale seaweed farming along the Florida Gulf Coast are under investigation. The Florida and Hawaii investigators are in regular communication with each other and with the rest of the relatively small seaweed scientist community.

UNIVERSITY OF NEW HAMPSHIRE, AQUACULTURE, PLANTS

The major red seaweed used for its jelling properties in the United States was the alga, Irish Moss (*Chondrus crispus*) which grows in Northern Atlantic waters. Sea Grant investigators for the first time have completely defined the life cycle and ecological requirements of this valuable seaweed, producing the knowledge necessary both for cultivation and for management of the natural resource. As an extra advantage of the Sea Grant system, the New Hampshire Principal Investigator spent his Sabbatical leave with the Principal Investigator of the University of South Florida project, thereby combining the marine algae knowledge and experience of the two universities.

UNIVERSITY OF CALIFORNIA, SANTA BARBARA, AQUACULTURE, PLANTS

Marine algae investigators at the University developed an underwater microscope, a powerful tool for use of all seaweed scientists.

UNIVERSITY OF WASHINGTON, AQUACULTURE, PLANTS

Gigartina exasperata is a member of a family of seaweeds from which agar, a third class of marine colloids, is extracted. The University developed methods of "vegetative propagation" (comparable to taking a slip from a flower or shrub, rooting, and planting it) and of controlling the amount of branching and initiation of new branches. This laboratory technique permits evaluation of various environmental changes on the seaweed, knowledge of importance in planning aquaculture ventures.

UNIVERSITY OF HAWAII, AQUACULTURE

The University, in cooperation with the Mardela Corporation of California, conducted a review of the state of the aquaculture arts in the United States, bringing together in a series of 12 regional conferences persons from industry, State agencies, Federal agencies, and the universities, to determine the needs and priorities of the broad aquaculture community. The report is being used by NOAA in defining its full aquaculture mission and plans, and by the general aquaculture community.

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OCEANIC INSTITUTE OF HAWAII, AQUACULTURE, FINFISH

Certain classes of marine fish have been notoriously difficult to spawn and grow. Among them are the mullets, underutilized in mainland waters, but a prized food fish that has been grown for centuries in the Pacific by seining juveniles and growing them in ponds. The Oceanic Institute has succeeded in the controlled spawning of mullet and is now making substantial progress in growing them to juvenile size, while developing the basis for a hatchery operation. The techniques will be adaptable to other, higher value food fish.

NORTH CAROLINA STATE UNIVERSITY, AQUACULTURE, FINFISH

The idea of culturing the dolphin fish (*Coryphaena*), a prize food fish under its Hawaiian name of mahimahi, originated at North Carolina State University's Sea Grant Program. The investigators so far have demonstrated that the fish grows at the phenomenal rate of nearly a pound a week, when adequately fed, and withstands captivity well. Working from North Carolina data and stimulus, the Oceanic Institute found, in a brief trial experiment, that the fish may be relatively easy to spawn. There are many hurdles to overcome before culture can be achieved, but the fish has been shown to be an excellent candidate.

TEXAS A&M UNIVERSITY, AQUACULTURE, OTHER

The concept of using thermal effluents from power plants for aquaculture is under investigation in several places and NOAA and AEC are planning a cooperative venture involving nuclear power plants. Texas A&M has demonstrated that supersaturation of gases in power plant discharge canals under some circumstances may cause gas bubble disease in organisms grown in the canals, thus enabling other investigators to avoid or anticipate this particular hazard.

LOUISIANA STATE UNIVERSITY, AQUACULTURE, FINFISH

Fish farming in the United States is beginning to have some impact on the economy, with freshwater catfish the leading species. To expand the catfish industry into brackish water in the South, it was necessary to demonstrate that freshwater catfish can be cultured in brackish-water ponds in the marsh regions of Louisiana and Texas. Sea Grant studies at LSU demonstrated that freshwater catfish can be grown in salinities of up to 8 parts per thousand (and can live at even higher salinities, although growth rates decrease). Production levels in the LSU experiments reached nearly one ton per acre per year. Many hundreds of square miles of marshland suitable for catfish culture presently are unutilized and, as a result of this research, catfish farmers have begun to move in. Farmers can gross up to $800 per acre per year on presently unutilized land. A supplemental advantage of brackish-water culture is that "ich," the most dreaded disease of catfish, is controlled in brackish-water ponds.

II. Fisheries

VIRGINIA INSTITUTE OF MARINE SCIENCES, COMMERCIAL FISHERIES

VIMS investigators have found that the rock crab, *Cancer irroratus*, frequents the Southern portion of Chesapeake Bay and molts extensively during the Winter. Their tests is that this species represents a potential resource for the crab dredge fishery because it can be utilized in the production of fresh, soft rock crabs in the Winter when only frozen soft blue crabs are available. The value of rock crabs previously unutilized has already risen from $5,000 to $15,000 as a direct result and the harvest is expected to increase in future years.

UNIVERSITY OF WASHINGTON, COMMERCIAL FISHERIES

A technique to estimate fish populations has been developed and tested by the University Sea Grantees and is being utilized by government agencies for population estimates necessary for management. The method appears to represent the accuracy of at least the same and possibly at lower cost than traditional techniques. The law prohibits use by commercial operators in the Pacific Northwest so the equipment is primarily useful for stock management at present. The "echo integration" acoustic technique. The University established the 1972 sockeye salmon smolt populations in Lake Washington and furnished the

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estimates to the State's Department of Fisheries for use in forecasting the 1974 sockeye runs.

UNIVERSITY OF CALIFORNIA, SAN DIEGO (SCRIPPS), COMMERCIAL FISHERIES

The Sea Grant investigators used acoustics for frequency analysis of fish swim bladders as a practical technique of monitoring the growth and survival of juvenile fish in California waters. NMFS is continuing support of the project because of its potential use in identifying species.

UNIVERSITY OF RHODE ISLAND, COMMERCIAL FISHERIES

Despite centuries of using nets for commercial fishing, there is a dearth of information on their hydrodynamic characteristics and no suitable engineering basis for net design other than "cut and try." As a part of its fishing gear hydrodynamics program, the University made drag evaluations on netting samples supplied by a commercial firm to permit calculation of the strength and type of nets necessary for aquaculture pens.

The University has developed an electric trawl system that increases the catch of lobsters at least 25% over traditional methods. The system, which shocks lobsters into lifting off the bottom sediments just before the passage of the net, also increases the quality of the lobsters because they are no longer entangled in silt, rocks, etc. Assuming a conservative 15% improvement in efficiency, the catch per unit effort would be increased by about $455,000 per year, based on Rhode Island landings of offshore lobsters caught by trawl under traditional methods. Assuming no change in resource management, over a ten-year period, value to the fishermen would be increased by more than $4.5 million at a Sea Grant cost of $137,500 matched by a roughly equal amount from local funds. Should fishery management require catch reduction, the principal value of the trawl would be in the improved quality of the catch.

UNIVERSITY OF RHODE ISLAND, COMMERCIAL FISHERIES, MARINE ADVISORY SERVICES

In early winter, sea herring move away from the Rhode Island shore and into midwater. Fishing for these stocks with a single boat pelagic trawl is uneconomical. To bring to the fishermen an effective and efficient method of utilizing the sea herring resource that would be competitive with fishermen of other nations, the University of Rhode Island Sea Grant Program worked with the Point Judith Fishermen's Cooperative to bring an expert in the handling of a two-boat trawl from Ireland to Point Judith to teach fishermen how to use the gear. Several boats from the Cooperative have adopted the technique and to date over 6,000,000 pounds of fish with a value of $120,000 have been caught. The cost to Sea was $2,400.

OREGON STATE UNIVERSITY, COMMERCIAL FISHERIES

OSU, under its commercial fishing methods and gear project, developed a combination trawl able to serve vessels ranging in power from 90 to 500 hp. The project modified, rigged and developed fishing methods for the Atlantic Western trawl and increased production to the fisherman of from 30-100%. Over 100 of the trawls are in use or on order on the Oregon Coast. Calculated on the basis of 100 trawls, increased annual production to the fishery is estimated at $2,750,000--for a Sea Grant Federal investment of $10,000 with matching funds of $4,000.

A project to improve the quality of fish delivered by fishing boats to supply a better product to the consumer and produce higher unit value to the fisherman was conducted successfully by Oregon State University. The project investigator researched the suitability of plastics for lining fish stowage compartments and developed methods of applying the plastics at the lowest cost. Since publication of the results, 129 boats have adopted plastic linings with an estimated average cost savings of $2,500 per vessel and improved sanitation for the catch. Total savings to date for the fishermen are estimated at $290,000--with a cost to the Sea Grant Program of $1,000 matched by $4,000 of local funds.

Investigators isolated and identified a viral disease of trout and salmon, resulting in formation of a committee by the Oregon Fish Commission to determine whether the Legislature should be asked to pass an act to prevent transportation of diseased fish into Oregon.

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Outboard motor-driven fishing vessels are an important component of the total fishery in the United States and in other parts of the world. The economic advantages of outboard motor propulsion have been limited by lack of a power take-off system from the outboard motor to operate fishing machinery. Under the OSU Sea Grant Commercial Fishing Methods and Gear Program, a power take-off from outboard motors was developed along with hydraulic gurdies of light weight and durable construction. The light-weight gurdies developed under the project provided a cost savings of $600-$1,000 each over heavier gear and fishermen bought from commercial suppliers about $175,000 worth of the new equipment in 1972. Sea Grant cost was $12,000, matched by $5,000 of local funds. Fishermen using a hydraulic power takeoff from outboard motors may increase their catch by 50-100%, depending on the fisherman, with subsequent increased income. Added benefits were: (1) the development of a dory fishery in American Samoa (funded by the Office of Economic Opportunity) with technical advice from OSU Sea Grant and (2) production of a publication on hydraulics—now widely used by industry in holding hydraulic clinics for commercial fishermen. Development of a second dory fishery under OEO funding and Sea Grant technical advice is underway in Ponape, Trust Territories.

University of Hawaii, Commercial Fisheries

Research by the National Marine Fisheries Service in the past has indicated that fish and crustacean resources in Hawaiian waters exist at greater depths than those normally fished by commercial enterprises. Information on whether or not species occur in quantities abundant enough to support a fishery has not been available, and the fishermen themselves have no facilities for making such determinations. Research under the University of Hawaii Sea Grant Program determined that pandalid shrimp are abundant between 160-200 fathoms and the trap rate at those depths is high enough to warrant consideration as a fishery. Application of the information depends upon capital investment both for a fleet of boats and a shrimp processing plant or two. The information has been made available to industry.

The Pacific skijack tuna fishery has depended almost entirely on a small anchovy, the nehu, which is not available in sufficient quantity and which has a high mortality rate in boat bait tanks. A project at the University of Hawaii produced new techniques for the handling of baitfish and effectively extended the time of fishing boats at sea from three to ten days. Although this increase is cost effective in terms of the present fishery, the baitfish problem requires further investigation. Sea Grant is cooperating closely with the Pacific Islands Development Commission and the National Marine Fisheries Service to apply university competence to the problem, particularly in the aquaculture of suitable bait species. The University also developed a night-light-lift-net system for sampling of nehu.

North Carolina State University, Commercial Fisheries

North Carolina State University Sea Grant personnel complied with a request for aid from North Carolina fishing vessels to improve their ice holding and fish keeping capabilities. The University project personnel determined that the problem was inadequate insulation of ice bunkers and fish holds and recommended the use of sprayed in-place polyurethane foam, developing a simple method of insulating older vessels. The technique was demonstrated on a standard shrimp trawler. To date, six vessels and two on-shore ice holding facilities have adopted the procedure, with an estimated annual saving per boat of $14,000. Sea Grant Federal cost for the research was $5,000 which was matched by $1,500 of State funds.

Introduction of North Carolina eels to the large European eel market is a recent development. The North Carolina Department of Economic and Natural Resources and a North Carolina exporter did an excellent job of identifying markets and establishing shipping and quality parameters. Problems tackled by Sea Grantees at North Carolina State University Extension Service have been in harvesting, holding, and purging of eels and transferring them live to the freezer plant. Project personnel evaluated pots, traps and nets used in other eel fisheries, and held meetings and demonstrations to inform fishermen of the eel market and to advise them of the methods and techniques. Project personnel also established contact with a seafood packer and processor and a broker-shipper who will buy and freeze the eels. A price system was established which will

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provide a good return to fisherman, processor, and shipper. At least 26 fishermen will be involved in eel harvesting in 1973; they are expected to export 250,000 pounds of eel this year, with a return of $75,000. Annual production is expected to increase. The project cost to Federal Sea Grant was $7,300 which was matched with $3,700 of local funds. As an additional benefit, the project director arranged for the area's workshop for handicapped and disadvantaged persons to make the eel traps for profit.

UNIVERSITY OF GEORGIA, COMMERCIAL FISHERIES

The twin trawl used by Gulf of Mexico shrimp fishermen was modified by Georgia marine extension specialists to increase the productivity and efficiency of the Georgia shrimp fleet. The changes include the use of a sled or dummy-door in between the two nets and the addition of a third wire to the bridle. Several vessels have installed this new system or are in the process of doing so.

III. Seafood Science and Technology

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, SEAFOOD SCIENCE

Squid is one of the most plentiful and least utilized resources in U.S. waters. MIT's Sea Grant project for product development has made substantial progress on canned, dried, and frozen squid products. Canned and frozen products were found to be of excellent quality and highly acceptable to taste panels. The most promising product appears to be a breaded squid ring which is deep fried. As a part of this program, a prototype machine for skinning and eviscerating the squid was developed which could be used by squid processors.

UNIVERSITY OF GEORGIA, SEAFOOD SCIENCE

A textured fish loaf has been developed from a combination of chunks of fillet, finely comminuted fish meat, and a binder. In an effort to develop new uses for underutilized fish, seafood scientists have found that both the Spanish mackerel and black mullet can be successfully smoked. One small processor is planning to initiate a smoking operation based on this work.

LOUISIANA STATE UNIVERSITY, SEAFOOD SCIENCE

Multiple activities in LSU's Seafood Science and Technology Department are underway, with results achieved to date in decalcifying crustacean meals to increase their industrial utility; in determining the cause of rancidity to crawfish; and in recombining mechanically picked and shredded crab meat into acceptable marketing form. LSU' work in aquaculture foods was noted previously.

TEXAS A&M UNIVERSITY, SEAFOOD SCIENCE

As a precursor to new methods of maintaining shrimp quality, TAMU found that gram-negative bacteria are responsible for quality deterioration.

UNIVERSITY OF RHODE ISLAND, SEAFOOD SCIENCE

Quality control methods and evaluations for fish meal and its applications developed by URI Sea Grantees are in use throughout the industry. The methods control production and provide nutrient data for computerized feed formulations. Anti-oxidant work now underway should be of substantial aid to industry in avoiding serious loss in fishmeal quality; this problem in recent years has caused financial losses and difficult problems in feed formulations at point of fishmeal use. In addition, new products have been developed which show promise as milk replacers for animal feeds; these products, which can replace high-priced dried skim milk, are of sufficient quality to be of possible use in human foods.

A two-solvent dehydration process was developed that produces fish protein concentrate of improved quality at a cost below that of earlier methods.

URI' scientists have found that saxitoxin, the poison in "shellfish poisoning," was linked with the dark melanine pigment in clam tissue. If farther work can demonstrate that the linkage occurs in the live clam, the door may be open to detoxification of poisonous clams and perhaps other molluscs. (A substan-

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tial part of the Northwest mollusc resource is underutilized, particularly in Alaska, because of shellfish poisoning, and an outbreak in New England in 1972 caused severe problems.) Such benefits are not in short-range prospect, because the problem is very complex, but results like this are important keys to future development.

The use of fish flesh in the preparation of sausages, fish balls, patties and breaded sticks and portions, has been evaluated with the flesh of various species (including some now underutilized) investigated for potential in the preparation of these and mixed-food products. Fish flesh, both intact and comminuted (finely shredded), in combination with sauces and other food materials, has been evaluated as a "boil-in-pouch" convenience food item. The OSU laboratory is working closely with industry in new product development efforts.

Until recently, Pacific shrimp was a product of little commercial importance, although the resource was plentiful. High direct labor costs made the profit position for shrimp processing uncertain. OSU introduced mechanical pickers to the fishery and demonstrated that a well designed mechanized production line could lead to potential cost reductions of over $20 per pound of shrimp, as compared with manual picking costs. Within the past two years, 19 mechanical pickers have been installed by Oregon processors.

NORTH CAROLINA STATE UNIVERSITY, SEAFOOD SCIENCE ADVISORY SERVICES

Seafood science and technology specialists working under Sea Grant Advisory Services at North Carolina State University have conducted research and made available information for the specific purpose of aiding new and established seafood processors in North Carolina. Direct assistance from Sea Grant beyond that commercially available was given on expansion, planning, sanitation, pollution, quality control, and processing methods, and contributed to 16 new plants and 13 plant expansions in the State.

OREGON STATE UNIVERSITY, SEAFOOD SCIENCE

The discovery of large amounts of mercury in fish caught in certain packing areas caused concern among Oregon fishermen and seafood processors about loss of consumer faith in the safety of their products. Under Sea Grant, the OSU Seafoods Laboratory demonstrated with certainty that Oregon bottomfish have less mercury than FDA standards and, in addition, the lab developed adequate industrial techniques for mercury analysis that can be performed in 30 minutes as compared with the usual 6 to 16 hours. The time saving permits plants to continue operation without holding fish a day or more for verification of mercury content. For those processors who previously risked the cost of canning and hoped that the analysis being performed simultaneously would prove favorable, the technique provides a significant cost savings. During the past year, there were about five occasions when processors using the new technique found tuna exceeding the FDA standard for mercury content. Previously, this finding would have meant the destruction of that day's canning (approximately 100 tons). (Tuna, a pelagic fish, may have a different mercury content than the bottomfish determined to be safe under the Sea Grant project.)

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, SEAFOOD SCIENCE ADVISORY SERVICES

Until recently, there has been no national program specifically designed to transfer technology of other areas to the seafood processing industry. An outstanding example was conducted by the seafood processors extension advisory service at the Virginia Polytechnic Institute and State University. Sea Grant personnel undertook to find new ways of pasteurizing crab meat, which at present is being pasteurized in cans along the east coast. The cans are relatively expensive, their opening requires considerable hand labor, some meat usually sticks to the sides of the cans and is lost, and the used cans constitute a waste disposal problem. The Sea Grant personnel developed a method to use flexible films to hold six pounds of crab meat and also developed the equipment necessary to package and process the product. Container cost was reduced by 90%, problems of can storage and waste disposal were minimized, opening the con-

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tainer reduced labor requirements, and there was less product waste. One firm which adopted the process reduced its annual production cost by $51,000 on a volume of 300,000 pounds. Cost to Sea Grant was $3,050, with $300 of matching funds. When it is realized that several million pounds of crab meat are available for pasteurization in Virginia alone, the effect of this new method of handling, if it is adopted by other firms, could mount into millions of dollars in savings to the industry.

UNIVERSITY OF WASHINGTON, SEAFOOD SCIENCE

Not only do Federal water quality regulations now prevent seafood processors from dumping wastes into coastal waters, but the wastes include valuable protein which should not be discarded. The University of Washington Sea Grant Program has successfully developed a method of extracting the high value protein from crab and shrimp processed wastes and turning the nitrates, which cause pollution problems, into gaseous nitrogen. An important part of the total activity is a Sea Grant to the Oceanographic Institute of Washington to support quantity production of chitin, the principal component of crab and shrimp shell, and chitosan, a marine polymer derived from chitin, in sufficient quantity for product research. The quality-controlled chitin and chitosan have been supplied to industry and to universities for research. A number of high value applications has been proposed, ranging from new surgical dressings to methods for controlled release of pesticides and herbicides. The objective is to find industrially valuable uses for what is now a nuisance waste product. At minimum, the benefit to industry from Sea Grant research, including the establishment of relationships necessary for a unified attack on the problem, has been acceleration of industry applications by at least one year. Full benefits will not be realized until the product has been completed and methods have been designed to collect and process wastes, turning them into valuable industrial raw materials. The project is in the pilot plant stage.

UNIVERSITY OF HAWAII, MARINE RESOURCES DEVELOPMENT, LIVING RESOURCES

The present coral jewel industry produces about $1.7 million worth of black coral and about $2.3 million worth of pink coral products at the retail level. Except for a brief period in the last decade when a small amount of pink coral was harvested locally, the precious coral industry in Hawaii has depended totally on imported stock of raw coral. The Oriental producers have raised prices and their production has been declining. This has made it necessary for the Hawaiian manufacturers to turn to local resources. Under a Sea Grant project, three major precious coral beds were discovered and charted. Appraisal of one bed off the southeast coast of Oahu resulted in an estimated value of $4.5 million worth of landed coral. However, research into ecology of the precious pink coral indicates that the bed's maximum sustained yield would be about $200,000 in raw coral annually, which would produce about $3 million in annual sales of processed coral. In addition, two new species of precious coral were discovered: gold, and bamboo. Two firms in Hawaii are at present building up reserves of the gold coral preparatory to introducing it into the market. Makai Range, Inc. demonstrated the economic feasibility of harvesting coral by submersible. The demonstration not only sustained the operation, but assisted in meeting Makai Range payrolls. A part of the benefit was the generation of twenty new jobs in the Hawaii precious coral industry. Using Sea Grant information, the National Marine Fisheries Service is developing management guidelines to protect the resource.

IV. Marine Resources Development: Minerals

UNIVERSITY OF HAWAII, MARINE MINERALS (SAND AND GRAVEL)

Hawaii is so short of sand and gravel that aggregates have been imported from Guam and the mainland. The University searched for offshore deposits and found one containing a million cubic yards of high-grade sand, and 6 of at least three and a half million cubic yards of aggregate. In a parallel project, the University Sea Grant Engineers designed an apparatus for recovering coarse bottom sand and have built a full scale working model which has proved capable of relocating sand (for beach replenishment) at a rate of 50 cubic yards per hour.

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UNIVERSITY OF HAWAII, MARINE MINERALS (MANGANESE DEPOSITS)

University researchers have discovered and charted a large deposit of manganese nodules and crusts in the Kauai Channel, at relatively shallow depths. Initial analysis indicates that the deposits may be high in platinum and rare earths of higher value than the usual nickel and copper content.

UNIVERSITY OF NEW HAMPSHIRE; RAYTHEON CORPORATION, MARINE MINERALS (SAND AND GRAVEL)

A joint project between the University and the Raytheon Corporation has determined that substantial sand and gravel supplies exist in parts of the Gulf of Maine and Massachusetts Bay. The team is now working on the environmental impact of mining these supplies as part of a larger program initiated by NOAA, based on Sea Grant results. Other agencies, including EPA, the Corps of Engineers, and the State of Massachusetts are participating with NOAA components. The project will provide environmental impact baselines for general use.

UNIVERSITY OF GEORGIA, MARINE MINERALS (INSTRUMENTATION)

Determining what subsea soils actually contain has been a laborious process involving bringing up samples with cores and then conducting laboratory analysis. The Sea Grant project developed a technique for neutron activation of sediments which can be used by divers, submersibles, towed sleds, or shipboard apparatus.

UNIVERSITY OF ROCHESTER, MARINE MINERALS (SAND AND GRAVEL)

When strict zoning, increasing transportation costs, and depletion of reserves made the supply of concrete aggregate sharply limited in the Great Lakes, the University of Rochester under a Sea Grant project undertook to determine the characteristics, extent, thickness, and economic potential of fine aggregate deposits along the southern coast of Lake Ontario. Three large and two moderately-sized sand deposits in the southern and eastern nearshore areas of Lake Ontario were found and defined. One of the deposits located at the mouth of the Niagara River at Rochester has an estimated worth between $90 and $150 million. One American company and one Canadian company have obtained permits and other companies have applied. If the lowest estimated worth of the Rochester deposit is used, the Federal investment of $75,700 matched by $40,000 has identified a deposit worth $90,000,000.

UNIVERSITY OF WISCONSIN, MARINE MINERALS (MANGANESE)

Surveys by the University of Wisconsin Sea Grant investigators established that a manganese mineral resource in the form of manganese pellets is located in the Green Bay and Sturgeon Bay areas of the Great Lakes. The worth of the manganese deposits has been estimated at $15,000,000 present market value. With the resource established, the University Sea Grantees are working with government management personnel to aid them in their assessment of the legal and environmental problems associated with harvesting the manganese resource. Until these problems have been solved, licenses cannot be issued. Total cost to Sea Grant for the project was $55,600 with matching funds of $15,000.

V. Marine Biomedicinals and Extracts

Note: The following items may be classed as research *results*, but not as benefits. Between the initial characterization of a potentially useful biomedicinal or extract and its final use there are dozens of important steps which may take more than a decade, and only a small percentage of the potential substances survive the process.

UNIVERSITY OF MIAMI, MARINE BIOMEDICINALS

Researchers have extracted from tunicates a substance that has been shown to have anti-leukemic activity in mice and anti-cancer cell activity in tissue cultures.

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UNIVERSITY OF CALIFORNIA, SAN DIEGO, MARINE BIOMEDICINALS

Starfish saponins have been shown to lyse (break down) tumor cells, but not the normal cells from which the tumor cells were derived.

UNIVERSITY OF RHODE ISLAND, MARINE BIOMEDICINALS

In another starfish extract investigation, URI researchers isolated and characterized both anti-viral and cytotoxic substances.

UNIVERSITY OF CALIFORNIA, RIVERSIDE, MARINE EXTRACTS

The first natural bromo-chlorides were found in a seaweed, the marine alga *Laurencia*. The extracts have been undergoing intensive testing at the Merck Laboratories.

OSBORN LABORATORY (NEW YORK AQUARIUM), MARINE BIOMEDICINALS

Two powerful, broad-spectrum antibiotics have been isolated, purified, and characterized from extracts of a marine sponge.

UNIVERSITY OF OAKLAHOMA, MARINE BIOMEDICINALS

Investors tested about 150 marine extracts for anticancer activity, and found that about a third show sufficient promise for further investigation.

VI. Ocean Engineering and Transportation

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, STATE UNIVERSITY OF NEW YORK, UNIVERSITY OF DELAWARE, LOUISIANA STATE UNIVERSITY, TEXAS A&M UNIVERSITY, PORTS, HARBOR AND OFFSHORE TERMINALS

Early in 1972 Sea Grant was invited to obtain input to a study respecting the accommodation of supertankers at U.S. sites for the Council of Environmental Quality. Specifically, best estimates were requested for specified spill scenarios at designated sites under consideration. Five institutional programs were augmented with funds from C.E.Q., and the local investigators, utilizing all currently available data, prepared reports evaluating the vulnerability of assigned sites in their areas. A summary report, to which the individual reports formed appendices, was developed by the Office of Sea Grant. The completed report was delivered to C.E.Q. in March 1973. In the interim, the investigators had extensive interchange with C.E.Q. staff, providing material for required interim reports.

LAMONT-DOHERTY INSTITUTE, ENGINEERING/AQUACULTURE

The ocean's most plentiful and least used resource is deep, cold water which is also high in nutrients. The Lamont-Doherty project envisions using the deep water for development of a system in which non-polluting electrical power generated by the Claude system, air condition, and nutrient supply for aquaculture can be produced. The cold water is piped to the surface. The first phase, use of the nutrient-laden water for aquaculture, has been successful. Algae are grown in the nutrient water, which is then piped to oysters and clams. The molluscs have shown very high growth rates. After the water has left the mollusc tanks, use of a cold water alga, Irish Moss, strips the water of the remaining nutrients so it can be returned to the environment without environmental damage. Applications of the temperature differential between the cold bottom water and warm surface water to operate a Claude power generating plant must await funds. For benefit to be obtained, the full system must be developed and applied in suitable locations. Aquaculture alone could not justify the system; aquaculture plus power production could, with about 25% of the power used to operate the system, and the rest sold.

UNIVERSITY OF NEW HAMPSHIRE, OCEAN ENGINEERING, OTHER

Engineering design of offshore structures and systems depends on wave input data. The University Sea Grant engineers designed, built, and are operating a

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directional wave spectra buoy system with a shore station for continuous recording of wave forces in the Gulf of Maine.

TEXAS A&M UNIVERSITY, OCEAN ENGINEERING, OTHER

A low-cost acoustic detector for use in undersea acoustic communications was designed, built, and tested, with results made available to the public.

UNIVERSITY OF WISCONSIN SEAFLOOR ENGINEERING

A sampler for unconsolidated sediments was designed, tested, and is now in use. The sampler is a hollow square probe operated by a vibratory "exciter."

TEXAS A&M UNIVERSITY, SEAFLOOR ENGINEERING

Working on a different sampling problem, that of long cores at moderately deep depths, Texas A&M incorporated the best features of existing corers into a single system capable of taking 3-inch diameter cores up to 50 feet long in depths to 1,000 feet, with cores always taken vertically.

LEHIGH UNIVERSITY, SEAFLOOR ENGINEERING

Sampling tools and methods were developed for research submersibles to aid both in mineral exploration and geological definition of continental shelf resources. The project was conducted with industry cooperation and support, with results tested off California and in the Gulf of Maine.

UNIVERSITY OF HAWAII, PLATFORMS

A preliminary design concept for a "floating city," with multiple uses as a sea-borne platform, was developed, with feasibility verified both through extensive computerized mathematical analysis and through the use of models, one a 1:150 scale model and the other a substantial 1:20 scale in Kaneohe Bay. Most of the work, including model construction, was performed by students and project volunteers from both student and faculty. In part, the work was based on a previous design studied by Sea Grantees at the Oceanic Institute of Hawaii, which resulted in initial design of a manned deep sea floating buoy. Whether or not the "floating city" is ever built, the data derived will have wide application in other types of sea-borne platforms. The 1:20 scale model has been put to use by the Navy for a series of calculations of Navy mission interest.

UNIVERSITY OF CALIFORNIA, BERKELEY, OCEAN ENGINEERING

Instruments have been designed and constructed for measuring wave forces on submerged horizontal cylinders, vertical surface-piercing cylinders, and assemblies of cylinders, a step essential to developing better engineering design criteria for such things as undersea pipelines and distribution systems.

UNIVERSITY OF NEW HAMPSHIRE STANFORD UNIVERSITY, OCEAN ENGINEERING

A submerged, floating pipeline capable of solving difficult problems of crossing ocean trenches and holes has been designed, and economic feasibility shown.

STATE UNIVERSITY OF NEW YORK, OCEAN ENGINEERING, POLLUTION-OIL SPILLS

A closed tank cleaning system for oil tankers has been designed for use at sea. The method should make it economically desirable for tankers to avoid pumping bilges with substantial oil residues by separating the oil from the water so that the oil may be stored for sale. The SUNY report is scheduled for presentation to the New York Society of Port Engineers in late March 1973, as a first major step in determining acceptability of the result.

STEVENS INSTITUTE OF TECHNOLOGY, OCEAN ENGINEERING

Stevens has developed procedures for predicting the motions of floating platforms, with particular emphasis on gas and petroleum drilling rigs operating on the continental shelf. The results have been directly applied by industry in improving floating platform design, and industry has made use of the Insti-

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tute's Davidson Laboratory as design consultants. The benefit is safer, more stable ocean platforms, but the improvement is incremental and not susceptible to benefit cost analysis. Fewer losses to storms is the probable benefit, but proof would be impossible even after the fact.

UNIVERSITY OF WISCONSIN, LIFE SUPPORT SYSTEMS

Sea Grantees have desi and produced prototypes of automatic depth and orientation devices for di The prototypes were tested successfully. A corollary result was receipt by grantees of 2nd Prize in the Lincoln Arc Welding National Design Competition.

UNIVERSITY OF NEW HAMPSHIRE, LIFE SUPPORT SYSTEMS

University engineers and physiologists developed a concept of biomedical telemetry using an acoustic link between diver and habitat or platform. The concept was tested successfully during project FLARE, early in 1972. When engineered into a production model, the system will permit dive managers to monitor the condition of divers during such stressful operations as petroleum wellhead completion, when the diver is using "free" gear, scuba or equivalent, hopefully providing early warning of stress that will help to prevent diver accidents and deaths.

UNIVERSITY OF HAWAII, DIVER PHYSIOLOGY

Diver work performance has been measured to provide operational management information. A physiological "marker" for individual diver susceptibility to nitrogen narcosis has been defined. In a separate effort, researchers looked at the effects of such common drugs as aspirin and decongestants on working divers, and have identified several which may pose physiological problems when the diver is at depth, under pressure, where physiological responses to medications differ from normal responses.

TEXAS A&M UNIVERSITY, COASTAL ENGINEERING

The effects of wave scouring on sand beaches in front of seawalls and dunes have been calculated and published, to aid in coastal construction designs; a series of computer programs for coastal engineers has been compiled to replace cumbersome hand methods of calculation.

STATE UNIVERSITY SYSTEM OF FLORIDA, COASTAL ENGINEERING

Predictions of littoral drift have been developed for all sandy beach segments of Florida. A model has been developed for predicting the effects of a large beach structure (jetty, etc.), or for predicting the behavior of a large beach nourishment project.

TEXAS A&M UNIVERSITY, TRANSPORTATION PORTS

At the request of the Maritime Administration a technical scope of work for offshore terminal feasibility studies was prepared.

VII. Marine Environmental Research

UNIVERSITY OF RHODE ISLAND, "RESEARCH & STUDIES IN DIRECT SUPPORT OF COASTAL ZONE MANAGEMENT DECISIONS

The University's Bay Watch Project has developed techniques for biological and physical monitoring of Narragansett Bay and is providing actual data for development of a computerized model which will be used by State coastal zone managers to determine in advance the effect of various decisions in coastal land use.

UNIVERSITY OF SOUTHERN CALIFORNIA, CZ MANAGEMENT RESEARCH

Investigation studies of the Southern California coastal region were conducted as the basis for assessing the impact of urban development on the coastal zone. The University also analyzed developments at the modern Marina del Rey for use in future marina development.

"Category hereafter abbreviated to "CZ Management Research."

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UNIVERSITY OF MICHIGAN, CZ MANAGEMENT RESEARCH

The University is using Traverse Bay as a model for developing a management system for the entire lake, and ultimately the other Great Lakes. The study covers socio-economic and legal factors as well as physical and biological factors, and provides constant input to Michigan law makers and State managers as data are developed.

UNIVERSITY OF WASHINGTON, CZ MANAGEMENT RESEARCH

Enough data to fill a book is literally the result of the University of Washington's research on resource management problems of Puget Sound. Throughout the study the investigators have been in communication with State authorities, providing data as developed. The book-length final draft is now being edited.

UNIVERSITY OF HAWAII, CZ MANAGEMENT RESEARCH

The University's research and advisory efforts provided direct assistance to Hawaii's State Senate Committee on Ecology, Environment, and Recreation, and to the Governor's Office of Environmental Quality Control in preparation of two pieces of major environmental legislation. The first portion of the University's study of multiple uses of the Hawaiian coastal zone was issued as "The Sphere of Federal Influence in Hawaii's Coastal Zone."

TEXAS A&M UNIVERSITY, CZ MANAGEMENT RESEARCH POLLUTION WASTES

A report on the broad topic of waste management in the Texas Coastal Zone was prepared specifically for the Governor's Office.

UNIVERSITY OF CALIFORNIA, SAN DIEGO AND SANTA BARBARA, UNIVERSITY OF SOUTHERN CALIFORNIA, COASTAL ECOLOGY AND CZ MANAGEMENT RESEARCH

The densely populated shoreline, particularly in Southern California, is the subject of continuing studies by California Sea Grant institutions. Specific results include:

UCAL, San Diego (Scripps made ecological studies of the nearshore zone and provided information to coastal planners so that possible effects of human activities could be estimated and distinguished from natural variations. The University also gave information to those concerned with agricultural harvests on the various consequences to the marine environment of various harvesting and pest control techniques.

UCAL, Santa Barbara made a study of natural oil seeps in the Santa Barbara Channel, with results given to county and regional planners to aid in identifying coastal areas subject to chronic and heavy concentrations of oily pollutants.

USC studied seasonal changes on Southern California beaches, their tolerance to oil, and the impact of human beach-users. The information has proved useful in preparation of an environmental impact statement by Southern California Edison Company.

STATE UNIVERSITY OF NEW YORK, POLLUTION

Researchers determined that when papermill discharge is abated, the affected region of discharge in Lake Ontario soon returns to normal conditions.

UNIVERSITY OF NORTH CAROLINA, ECOSYSTEM RESEARCH

Brackish ponds serving as test ecosystems to specifically determine the effect of secondary-treated sewage on the environment have shown that the sewage causes explosive growth in desirable marine plants and animals.

SAN JOSE STATE COLLEGE, MOSS LANDING MARINE LABORATORIES, POLLUTION

Sea Grantees at Moss Landing Marine Laboratory joined forces with the Kaiser Aluminum and Chemical Corporation to determine the potential effects on the marine environment of siting the outfall of effluent from the Kaiser Refractories offshore in Monterey Bay. The Refractories had been discharging industrial effluent into Mayo Cojo Slough at the rate of 36 million gallons per day. As a result of the research, recommendations were made concerning the estab-

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lishment of a new outfall so that acceptable levels of environmental quality might be maintained. The Bureau of Sports Fisheries & Wildlife (of the Department of Interior) and the San Francisco District of the Corps of Engineers utilized the research report as a major information source. The request for a permit was approved and the outfall was constructed, utilizing the Sea Grant recommendations.

UNIVERSITY OF DELAWARE, POLLUTION

Sea Grantees researched and reported on control of metal levels in shellfish, at the request of the Delaware Department of Natural Resources and Environmental Control.

STATE UNIVERSITY OF NEW YORK, POLLUTION

A simple, rugged, electrochemical method has been developed to determine the presence of mercury in water to one-tenth part per million.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY, POLLUTION

A computer model has been completed simulating meteorological and oceanographic conditions of offshore New England, permitting the track of a hypothetical oil spill to be calculated and the time of landfall to be predicted based on spill location and weather conditions. It is hoped that the model never need be used-- but if a spill occurs, predictions of results can now be made.

UNIVERSITY OF WASHINGTON, RESOURCE MANAGEMENT

Prototype development and partial implementation of two computerized management systems for fishery data have been completed, utilizing environmental and stock data. A game, with which managers can sharpen their management skills, is an offshoot of the project. The computer game, called "Simple Salmon," poses the problems of managing a salmon resource.

VIII. Socio-Economic and Legal Studies

TEXAS A&M UNIVERSITY, SEAFOOD MARKETING

Out-dated forms of merchandising seafood products which have made them noncompetitive with other meat products led Texas A&M University Sea Grant to a pilot study of seafood distribution activities and merchandising in the Gulf Coast region. The investigators developed merchandizing strategies and an initial management accounting and record-keeping system to permit management to determine which merchandizing strategies were most profitable. The system plan was tried out in a local supermarket. The pilot project increased average weekly volume of total seafood sold by 84%, boosted average weekly dollar sales volume 80%, and increased the average weekly profit 152% over values previously obtained with traditional marketing strategy. Over 40 retail merchants have been in contact with the Principal Investigator to obtain information on seafood merchandizing. A one-day workship was held in Houston to demonstrate retail seafood merchandizing practices to approximately 30 retailers. Economic return under the pilot project alone was $15,964, representing more than double the Sea Grant cost of $4,670 with matching of $2,330.

UNIVERSITY OF WASHINGTON, ECONOMICS-FISHERIES

In a purely local case, the University of Washington developed an economic study of a single county to determine for county managers the relative economic importance of the local fishery and fish processing industries so that this information could be compared with the economic value of alternative and potentially conflicting industrial development.

TEXAS A&M UNIVERSITY, ECONOMICS-RESOURCES

University Sea Grant economists developed a major study for the entire State of Texas, assessing for the first time the economic interrelationship and impact of the marine resources and industries of the State. Over 700 individual industrial firms, State agencies and individuals participated and received copies of the report.

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UNIVERSITY OF WISCONSIN, ECONOMICS-TRANSPORTATION

The University conducted a benefit cost analysis of the effects of extending the St. Lawrence Seaway Navigation system, while scientists were working on the feasibility of various methods of keeping the seaway ice-free for a longer period. The study, conducted in cooperation with seaway officials and port directors, specified values that would be obtained from season extensions of various lengths. The study was instrumental in the decision to extend the seaway season.

HUMBOLDT STATE COLLEGE, ECONOMICS-RESOURCES

Humboldt State, in northern California, organized, conducted, and printed proceedings of a conference on the economic potential of California north coast marine resources, with industry and State officials participating.

UNIVERSITY OF SOUTHERN CALIFORNIA, ECONOMICS-MANPOWER

The University, in an area faced with significant aerospace unemployment, conducted and published a feasibility study on the transferability of unemployed aerospace manpower to marine affairs, and reported in detail the problems and potential.

TEXAS A&M UNIVERSITY, ECONOMICS-MANPOWER

Texas A&M engineers conducted a national survey to determine industry requirements in the training of ocean engineers and published the report for the use of engineering education and industry.

TEXAS A&M UNIVERSITY, ECONOMICS-COASTAL ZONE

The University issued a detailed report on economic development and factors affecting industrial location on the Texas Gulf coast for the benefit of interested industries and State agencies.

UNIVERSITY OF RHODE ISLAND, ECONOMICS-RECREATION

A URI study determined the economic impact of recreational boating, with emphasis on the impact a Rhode Island marina has on the local economy.

UNIVERSITY OF MICHIGAN, ECONOMICS-RECREATION

A survey of 1200 users of recreational areas altered State policy with regard to State development of "modern campgrounds." The State determined from the study that it was best to let private firms develop most of the campgrounds, putting the State's own resources into more "natural" parks.

UNIVERSITY OF WISCONSIN, ECONOMICS—RECREATION

Recreation demand figures for the Green Bay area developed by a study are being used by at least two counties in preparation of their outdoor recreation resources plans, which each county must have accepted by the State before they can receive State funds.

TEXAS A&M UNIVERSITY, ECONOMICS—FISHERIES

A method of obtaining optimal investment strategies for shrimp fishermen is developed and illustrated in this report. It is designed to enable shrimp fishermen with a given amount of capital to obtain guidelines for financial decision making. Demonstrations of the profitability of such strategies have been given to shrimp firms and fishing equipment suppliers.

UNIVERSITY OF RHODE ISLAND, ECONOMICS—AQUACULTURE

The University made an economic analysis of salmon aquaculture and determined the feasibility of culture for food fish markets.

UNIVERSITY OF RHODE ISLAND, ECONOMICS—MINERALS

The potential economic and environmental impacts on New England of the exploration of offshore oil was studied and a preliminary report issued.

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LOUISIANA STATE UNIVERSITY, ECONOMICS—COASTAL ZONE

LSU made a complete economic base study of coastal Louisiana for government and industry use and, in addition, made an economic analysis for the Louisiana Superport study.

UNIVERSITY OF WISCONSIN, SOCIAL STUDY

As part of its program to assist State managers in environmental matters, Sea Grantees conducted a study to determine how the public perceives questions of water quality, as distinct from how specialists and managers view the problem. Because environmental measures depend on public support to a large extent, public perceptions must be taken into account in planning and management decisions.

UNIVERSITY OF OREGON, LEGAL STUDIES

As part of the Oregon State Sea Grant College Program, the University of Oregon is developing a handbook on fisheries law specifically for the northwestern fishing community, obtaining feedback from professional fishermen as the handbook is developed. It covers such factors as insurance and loans as well as Federal and State regulations, and details fishermen's rights as well as legal responsibilities. The University also has published a special edition of the Oregon Law Review with analyses of various aspects of ocean resources law.

UNIVERSITY OF MAINE, LEGAL STUDIES

In the first study of its kind, the University of Maine Law School made a complete compilation and analysis of Maine laws, regulations, and decisions affecting marine resources. The study, in five volumes, is a mode for other States and is a continuing resource for State legislators.

TEXAS A&M UNIVERSITY, LEGAL STUDIES

Under the Texas A&M Sea Grant College Program, a consortium of Law Colleges (University of Houston, University of Texas, and Texas Tech) is identifying and defining legal-administrative problems in the use and development of State marine resources, with advisory service activities being created for assistance to State officials and business and industry.

UNIVERSITY OF MIAMI, LEGAL STUDIES

The University of Miami Law School has prepared a preliminary analyses of the diverse legal jurisdiction problems of the coastal region, noting the multiple levels of governmental authority, including the uncertain limits of Federal and State agency authority. Legal uncertainties are, the report notes, products of agency decision processes rather than a separate body of law. University of Miami lawyers also have assisted the State attorney general in analyzing recent State aquaculture legislation to determine the scope and limitations for commercial aquaculture under the Act, and to assist in approving requests for commercial leases.

UNIVERSITY OF WISCONSIN, LEGAL STUDIES

University of Wisconsin Sea Grantees have prepared a report that examines the legal ramifications of Canada's Arctic Water Pollution Prevention Act, as a guide for officials and industry.

UNIVERSITY OF NORTH CAROLINA, LEGAL STUDIES

The University of North Carolina Law School has published papers prepared by students in international law on attitudes regarding a law of the sea convention to establish an international seabed regime.

IX. EDUCATION AND TRAINING

The National Sea Grant Program was launched at a time of high expectation that marine industries would grow rapidly and that a considerable amount of new manpower would be needed. The expectation was augmented by the conclusions of the President's Commission's on Marine Science, Engineering, and Resources (the Stratton Commission), which recommended more education, and

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training for marine manpower, particularly by Sea Grant. Emphasis was recommended for marine technician training.

Sea Grant did institute or augment a number of technician training programs, stimulated initiation of graduate programs in ocean engineering, law, economics, and marine affairs, and provided support for improvement of existing graduate programs in marine disciplines. Fortunately, since benefits are primarily employment for graduates and provision of qualified manpower for employers, the Office of Sea Grant was conservative in its approach, requiring schools--particularly those training technicians--to show reasonable probability of placing all qualified graduates.

When it became apparent that marine business and industry would not grow fast enough to absorb all qualified graduates, including some thousands of undergraduates and graduate students not in any way connected with Sea Grant, initiation of new activities was stopped. Gradual phasing out of support began in FY 1972 and is being accelerated in FY 1973. Institutions with soundly-based programs, which turn out the kinds of graduates wanted by industry and government, will continue to do so. In most cases, support gradually has been taken over by the state or county. In a few cases, programs may disappear or undergo change, but this is probably not to be regretted in most instances.

Support for graduate programs of proven value will continue until they become self-sustaining. Further, some undergraduate experience programs are of such high value that continued support is warranted. But, on the whole, the percentage of Sea Grant effort devoted to education and training will be reduced until such time as a need for expansion can be justified.

A distinction must be made between graduate participation in research and graduate courses as such. Sea Grant has been most fortunate in its graduate student research. A number of first rate students have done their research dissertations with Sea Grant sponsorship, making substantial contributions to Sea Grant goals. Some of those students have completed their education and are now in key positions in industry and State and Federal agencies. (By happy coincidence, Sea Grant cooperative activities with the Environmental Protection Agency are conducted with two former Sea Grant graduate students who were not known personally to the Sea Grant Office before they turned up as opposite numbers.) Sea Grant research participation will continue, as will graduate courses in law, economics, and marine affairs.

Benefits

Benefits are most easily expressed in statistics of employment on graduation, but statistics are presented with some misgivings that they may be taken too literally. There is no such thing as a purely marine education or training program, and a student acquires skills of use on land as well as in the marine environment. In some cases, statistics can be cited of actual employment in marine affairs, but in most cases only gross employment is reported to the Office of Sea Grant. An unknown percentage of the total figures represents students who found land jobs in which their marine skills might or might not have been useful.

When a breakdown of marine versus other employment has been reported, the figures are given.

All figures represent students who actually went into the employment market on course completion or graduation. Not all students did so. Many chose to continue their education, some went into the Armed Services by choice or draft, and a few decided to take an extended vacation and were lost to the statistical mill.

The following items capsule some of the results of Sea Grant Education and Training:

University of Wisconsin reports 100% placement of all graduates. The University has only graduate level ocean engineering under Sea Grant.

The *University of Washington* Ocean Law Program graduated four Masters of Law candidates, 1970-1971. Employment was at Seaton's Institution, U.S. Senate Commerce Committee, Chevron Marine Transport Company, and private practice, Seattle.

At the *University of Southern California*, the Sea Grant Laboratory Workshops in Coastal Zone Planning resulted in student placement as follows: Two graduates employed in environmental management agencies and three as planners in coastal cities. Two continuing students are serving internships in Sacramento working in State coastal zone planning. The University's Graduate Program in Marine Affairs is too new to have graduates, but the Long Beach

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Director of Harbor Development employed a student intern whom he hired full time.

Mississippi State University Institute of Technology produces bachelor-level "shirtsleeve" engineers especially trained for the ship service and support industry. Small classes, from six to ten students are graduated each year. The placement record in the ship service industry is 100%. Some industries pay student tuitions and offer summer employment, then hire the students on graduation. Starting salaries average $883 per month with a high of $950.

Florida Atlantic University conducts a "work-study" program in which the students alternate between campus and employment in marine industry, taking five years to finish a BS degree. As of June 1972, seven work-study classes were completed, with 75 students and 30 industries participating. Eighteen students were offered full time jobs by their cooperative employers, representing 24% of students graduating. This project was a rapid indicator of change. When it started, there were employers asking for students and not enough students to go around. In two years, the ratio shifted and Sea Grant support was phased out.

Santa Barbara Community College initiated a program for underwater technician training which has become nationally known for the quality of its graduates. One hundred percent of those entering the employment market has been placed, with 20 of the 25 graduates in June 1972 going to work for major diving companies. Ninety percent of the class of '72 was employed outside the State.

Seattle Community College graduated three students who went into the marine trades—a highly misleading statistic. The students attending at Seattle do so to get special marine courses, in marine electronics, diesel work, shipfitting, and so on, and leave for employment when the courses are completed without attempting to get degrees. A large number has been hired right out of the school before course completion. This very successful program serves a definite need for those who wish to learn or brush up on skills to increase their employability.

The University of New Hampshire has, for four years, conducted a Sea Grant course of undergraduate ocean engineering experience. Students from many disciplines conduct specific projects during the course. The students do not graduate as marine specialists, but do get practical experience in a marine problem-solving atmosphere—skills of value to their careers. The most dramatic result of one student project was creation of the undersea habitat, EDALHAB, built with a donated tank, scavenged equipment, and many hours of student volunteer labor. The habitat was used off the Isles of Shoals and later by NOAA in PROJECT FLARE, the Florida Aquanaut Research Experiment.

Highline Community College in Midway, Washington, initiated under Sea Grant a program for training underwater technicians. Quality of the program and students was so high that the senior class served as support divers for PROJECT TEKTITE II, receiving commendations from both industry and government. Although Sea Grant support has phased out, the program continues, with the school and its students providing many services to underwater activities in Puget Sound. The percentage of graduates placed in commercial diving is relatively low, about 65% at last report, for a purely local reason: many students refuse to leave the Northwest area where diving jobs are scarce, even though jobs are available in other places.

Massachusetts Institute of Technology conducts an interdisciplinary system design program involving both graduate and undergraduate students, with MIT students often augmented by students from other schools; e.g., law students from Harvard Law School. The 1970 study report, "Power, Pollution, and Public Policy," published in 1971, received wide acclaim, with over 2,000 copies distributed. The Senate Committee on Interior and Insular Affairs used two chapters of the report in its studies of national land use policy.

Texas State Technical Institute, under Texas A&M Sea Grant Program, trained well marine technicians and placed them in marine-related industries in 1972.

Cape Fear Technical Institute, Wilmington, North Carolina, consistently has reported 100% placement of marine technician graduates. Cape Fear students, toward the training and research ship *Advance II*, have supported a number of scientific operations, including BOMEX, IFYGL and TEKTITE.

Shoreline Community College, Seattle, Washington, reports 100% placement of marine technicians. The school specializes in field and laboratory biological technicians who have proved particularly useful in organizations dealing with environmental research and monitoring.

Clover Park Vocational Institute, located near Tacoma, Washington, graduated 24 students in its first commercial fisherman's class, of whom 23 went to work in fisheries operating out of Puget Sound. Two of the three were drafted.

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Before *Clatsop Community College* in Astoria, Oregon, was able to graduate its first commercial fisheries class, eight students were recruited right out of the classroom for the Alaska fisheries. Clatsop students go primarily into the Oregon dory fishery as individual entrepreneurs, with a smaller number working on albacore, halibut, and other larger boats.

University of Miami's Master of Laws Program in Ocean Law has had 14 graduates, all of whom are presently employed in marine-related fields. Another ten students who have not yet formally completed the program are also employed in marine-related jobs. This is the first such program in the United States and its graduates are serving Federal and State governments, academic institutions and private firms. Theses produced by the students have been utilized widely.

Peninsula Community College in Port Angeles, Washington graduated 13 students of whom seven had jobs upon graduation. The remaining six students were awaiting Civil Service examination results before job placement. The main objective of this program is to prepare students for employment as technicians with agencies and industries concerned with pollution chemistry.

The *University of Rhode Island* Sea Grant Program established the first graduate program leading to a Master's Degree in Marine Affairs. In 1972, the entire graduating class found employment in marine-related works; overall, of the three graduated classes in the Master of Marine Affairs Program over 95% has been employed. Eighty-two and five tenths percent of those graduated have been employed in marine-related jobs. Also during 1972, three new courses were added to the curriculum. This program is aimed at broadening the backgrounds of executives from various Federal and State agencies as well as private industry to make them better equipped to deal with decisions affecting marine affairs. Forty-one of the 57 graduates previously had jobs to which they returned upon graduation. Among the recent graduates of the program is Robert Knecht, Acting Head of NOAA's Office of Coastal Zone Management.

X. Advisory Services

Advisory Services is the mechanism for transferring scientific and technical information to users. Techniques include personalized extension services, workshops, special courses, publications of many kinds, and use of mass media.

In 1972, the Administrator, NOAA assigned responsibility to the Office of Sea Grant for initiation and leadership of a total NOAA Marine Advisory Program, involving all elements of the agency and close coordination with such other agencies as the Department of Agriculture and the Cooperative Extension Service, and agencies of the Department of Interior. This broad program is still in the initial planning stages, with principal participation by the Sea Grant network advisory services and the National Marine Fisheries Service.

Results reported in this section relate only to the Sea Grant Advisory Services in the Universities.

It is often difficult to distinguish between research and advisory services, because many extension personnel are qualified researchers able themselves to conduct a study or project to answer a specific need or inquiry. A few cases, where the distinction is blurred, were reported under research categories.

Specific activities are not reported in the same way as results of research projects; so much is going on that the mass of paperwork would be prohibitive. The following sampling represents a small percentage of the total and is limited to those activities which surfaced during site visits to the institutions, were separately funded and hence reported upon or reported to the Sea Grant Office as special cases.

PASGAP, the Pacific Sea Grant Advisory Program, is a regional advisory organization put together by Sea Grant Advisory Program leaders in Oregon, Washington, California, Alaska, British Columbia, and Hawaii, with additional participation by the National Marine Fisheries Service. Its purpose is to make maximum use of personnel or materials generated by any member. For example, when a small boat fishing gear need arose in the Pacific, arrangements were made for a specialist from Oregon to assist. PASGAP's first regional product was a *Commercial Fisherman's Directory of Emergency Services*, containing names, addresses, and telephone numbers (plus radio call signs when appropriate) of nearest Coast Guard stations, marine radio operators, electronic repair services, public health physicians, marine service stations, refrigeration facilities, seafood buyers and canners, dockside grocery stores, machine shops, shipyards, welders, and marine suppliers. Services are listed alphabetically by town name for State

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and Province from California to Alaska. As of October 1972, 10,000 copies had been distributed and an additional printing had to be ordered.

NEMRIP, the New England Marine Resources Information Program, is a regional advisory organization which covers the New England States and has similar objectives to PASGAP. Its principal activities include serving as an information clearinghouse, sponsoring workshops, and providing some staff on a regional basis. Last year, NEMRIP processed 3,628 requests for information and distributed 14,219 publications. It also initiated a seven-state Economic Analysis of the Marina Industry in New England and New York with the cooperation of the various state universities.

The *University of Delaware* has instituted a sport fishermen's "hotline." Information recorded daily includes what is being caught where, and with what bait, wind and water conditions, a weather watch, and an occasional lesson on boating safety. Initiated in July 1972, the "hotline" has received more than 13,500 calls so far and the volume is growing rapidly as fishermen become aware of the service.

The *University of Wisconsin* responded to a request from a commercial fish processor on Lake Michigan to investigate a waste water disposal problem. A two-stage treatment process was developed which provided additional produce recovery and improved waste water treatment.

Oregon State University, in a continuing effort to upgrade the efficiency and sanitation of the many small seafood processing plants in the State, developed a training film on its new process for crab meat extraction. The film, accompanied by a training manual, is in use throughout the Northwest. Film quality was recognized by an award in national competition.

North Carolina State University extension engineers built and conducted sea tests of an electric shrimp-fish separator trawl that caught as much as a standard trawl, but reduced the number of fish caught by two-thirds. The North Carolina State extension personnel also provided technical assistance to a scallop processing plant in designing a direct oil-fired heat exchanger submerged in the scallop thermal shucking tank to facilitate the shucking of scallop meats. Capability of shucking operation was improved 100% over the old method.

Twenty-three cooperating private persons and companies were supplied with yearling American and European oyster seed and with young of the year in 1972 so that the *University of Maine's* aquaculture research could be applied to State aquaculture as soon as possible. The cooperating individuals and firms were urged to innovate in developing culture methods, with technical advice given by the Sea Grant team at the University. Of the original group, twelve have expressed interest in going into commercial ventures in 1973.

The *University of Wisconsin* convened a conference on environmental impact analysis with emphasis on marine problems and attracted nearly 100 participants from 26 Federal and State agencies. The proceedings were published as a working document for agencies required to develop environmental impact statements.

Texas A&M compiled basic marine insurance data from members of the Texas Shrimp Association and prepared an analysis that was instrumental in the Association's efforts to secure an insurance proposal from a reliable marine insurer.

In a statewide effort to help Oregon processors upgrade fish smoking methods to meet FDA standards, the extension specialists at the *Oregon State University* Seafoods Laboratory in Astoria measured temperatures of smoking ovens in processing firms and held workshops on smoking techniques and sanitary procedures. Although the service was aimed at the small processors with no capability of their own, it was used by the largest plant in Oregon—finally resolving a costly minor disagreement between plant engineers and managers.

Engineers at *Texas A&M University* conduct annual seminars on dredging to help industry keep up with the state of the art. Proceedings are published for industry use.

Oregon State University's Extension Economist devised a simple bookkeeping system for fishermen which has proved so effective that fisheries in other states are adopting it, modifying as necessary.

The City of Michigan Sea Grantees answered a request for aid from Traverse City, assisting the city in obtaining funds to purchase a packing plant on the waterfront so it could be removed as part of the city's shoreline beautification. Because of this aid the packing plant decided to move to a new location to the benefit of the whole downtown area.

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When it became clear that high school counseling in marine careers was uniformly poor and groups in Boston approached the Sea Grant Office, a prototype guidance counseling project was funded combining the facilities of *Boston University*, the New England Aquarium, and the Boston Sea Rovers diving club. The guidance project has become an annual affair, with counsellors, science teachers, and students spending two days in Boston for extended seminars and workshops with professionals in various marine careers. Sea Grant support has phased out but the activity continues, and is so needed and successful that it has spread to Philadelphia, Chicago, Galveston, Miami, Los Angeles, and Seattle. All "career days" follow the general pattern of the Boston prototype, with local variations. Beyond the initial small Sea Grant, no Federal funds have been necessary. Office of Sea Grant personnel continue to give guidance and technical advice on request and Sea Grant institutions participate in career programs in their areas.

(The following information was referred to on p. 14:)

Working Relationships Between the Office of Sea Grant and Other Federal Agencies

Section 204(a) of Public Law 89-688 (Sea Grant Act) states ". . . In carrying out the provisions of this title the Foundation shall (1) consult with those experts engaged in pursuits in the various fields related to the development of marine resources and with all departments and agencies of the Federal Government (including the United States Office of Education in all matters relating to education) interested in, or affected by, activities in any such fields, and (2) seek advice and counsel from the National Council on Marine Resources and Engineering Development as provided by section 205 of this title."

Because of this statutory requirement and the similarities in program scope between the Sea Grant (OSG) mission and the missions of many other Federal agencies, the need for the closest possible cooperation has been obvious to the OSG staff from the program's inception. Accordingly, one of the most important tasks has been the forging of useful managerial links. The legacy of interagency harmony inherited from the now defunct Interagency Committee on Oceanography gave OSG efforts a head start at the outset of the program.

Because the program began in the National Science Foundation (NSF) it was natural that its administrative procedures were those of NSF, e.g., peer panel review, site visits by teams of experts, and so forth. By definition, such procedures required close collaboration with other Federal agencies. Achievement of close collaboration was relatively simple because of the applications orientation of the Sea Grant program. This applications orientation, similar to that of the "in-house" programs of Federal agencies, contrasted sharply with the fundamental science nature of other NSF programs.

This résumé summarizes the history of OSG contacts, their present status, and an estimate of their effectiveness.

V. Health, Education and Welfare

1. Office of Education (OOE)

The Office of Education is selected for initial treatment because it is the only organization mentioned in the Act (Section 204(a)(1)). OSG's efforts to establish a working relationship are described in enclosure (1) to this report.

In 1970, through contacts with the Division of Higher Education, the Director of the Office of Sea Grant arranged for an interview with several representatives, particularly those concerned with research and development, of OOE. The purposes were to explain the OSG program, to emphasize the need for cooperation between the OSG program office and the Office of Education in Marine Education, and to elicit from them a degree of understanding that would permit OSG to relate to their on going programs. At the close of the interview, the Director, OSG, left with them several documents describing the National Sea Grant Program, particularly its educational functions.

Later in 1970, and again in 1971, the OSG Director contacted Boyd Ladd, with who he had served on the National Council of Marine Resources and Engineering Development. (Ladd is now employed in the Statistics Branch of the Division of Higher Education.) Following the first talk, he explored the possibilities of extensive collaboration between NOAA and OOE.

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The next step toward a general operating agreement will depend on the answer to the letter (enclosure 1).

Cooperation with OOE on specific items has been achieved. For example, Harold Goodwin of OSG undertook lengthly negotiations with the Technical Education Research Group of OOE to develop a joint project to assess requirements nationally for technicians. Although agreement to cooperate was reached, the OOE group was unable to fund its portion of the study and OSG did not have sufficient resources to pay for the whole study. Further, there was considerable doubt about the scope of the proposed study and its applicability to the real world. Since then, the group has been abolished in OOE. As another example, OSG has always invited representatives of the Office of Education to OSG sponsored workshops on technician training. Walter Brookings, an OOE specialist in vocational training, has attended all of these sessions and his input has been valuable to the meetings. Brookings also has regularly reviewed OSG proposals.

2. National Institutes of Health (NIH)

In 1969, at the instigation of OSG, a meeting was convened at the National Academy of Sciences. Attendees included representatives of OSG, the National Cancer Institute, the National Institute of Internal Medicine, National Medical Institute, and a few representatives of the scientific community. The subject of the meeting was sponsorship of R&D in Marine Pharmacology. Until that time, NIH had borne nearly total responsibility for Federal support of research in pharmaceuticals from marine organisms. NIH representatives stated, however, that because of budget difficulties and managerial trends, it was unlikely that they could continue to support projects in this field; they desired, therefore, to transfer their cognizance to the National Sea Grant Program. It is significant to note the Congressional interest at the time in this particular area. A Congressional group headed by Senator Warren Magnuson attempted to draft legislation to establish a National Institute on Drugs from the Sea.

OSG agreed to accept the marine pharmacology responsibility, particularly because some starts had already been made in this direction and the subject had been discussed in previous Congressional hearings. All relevant proposals received by OSG were sent to NIH for review as to the general merit of the proposal, the degree to which there was duplication of previous work, and its relationship to the state of the art.

Relationships with NIH since that time have been cordial, and the Institute has been helpful in screening proposals and contributing manpower for on-site visits wherever marine pharmacology has been prominent in the proposals. Although the NIH budget outlook appears somewhat better than in previous years, its concentration on cancer, et al., precludes the possibility that NIH will reassume much responsibility for marine pharmaceuticals. Accordingly, unless OSG maintains its position, research on this important subject will have to depend on other sources for continuation.

Cooperation on specific items will continue. At the request of NIH, David Attaway of OSG attended a work session to assist in briefing NIH review committees on Sea Grant criteria and procedures for support of drugs-from-the-sea research. Goodwin has obtained the cooperation of James King, the Deputy Surgeon General of HEW, who is responsible for international affairs in the unified ciguatera* project. King has been notified that Sea Grant has been forced to cancel its ciguatera effort, so that the Office of the Surgeon General can pick up portions of the unified program if funds are available. Man-in-the-Sea activities also are coordinated regularly with NIH, usually through Vincent Price. Price has acted as a reviewer and adviser, particularly on Man-in-the-Sea matters involving physiology and related research.

B. INTERIOR DEPARTMENT (DI)

From the beginning of the Sea Grant Program, it was evident that the program's fortunes would depend to a large degree on cooperation and mutual work with DI which has several agencies charged with work closely related to that of the Office of Sea Grant. Accordingly, in the early stages of the program a meeting was convened between the Assistant Secretary of Interior for Fish and Wildlife and Parks and the Assistant Director of the National Science Foundation.

*An ailment caused by eating poisonous fish.

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The meeting was attended by policy level representatives from nine DI bureaus and from the NSF Sea Grant Office. It was agreed that similar meetings would be held annually to discuss policy and trends of cooperation, and to ensure continuing collaboration between the departments. At that time, an Interior Coordinating Committee for Sea Grant was established under the guidance of the Science Advisor to the Secretary of the Interior. The Chairman of the Committee, also the Sea Grant Coordinator for Interior, was assigned from the (then) Bureau of Commercial Fisheries.

The agreement provided that all proposals to the NSF Sea Grant Office that related in any way to living resources would be forwarded to the Sea Grant Coordinator for DI. The Sea Grant Coordinator would be responsible for distributing copies of the proposal to all DI agencies possibly interested in the work. Each of the recipients responded and returned the reply form to the NSF Sea Grant Office via the Interior Coordinator. A copy of the form used is attached (see enclosure 12)).

This kind of guidance was useful for evaluating proposals. It served two purposes: providing both technical assessment and insurance against overlapping or duplication of effort between the two groups. Further, site visits have seldom been made without the presence of at least one DI representative, normally from the Bureau of Commercial Fisheries (BCF). In nearly all cases, the Director of the local BCF laboratory was not only present at the site visit, but was a major contributor during the executive session because of his advanced knowledge of the local institute.

In retrospect, it is interesting to note the degree to which the Sea Grant response to institutional proposals has been affected by the opinion of the BCF laboratory directors. In several cases these opinions have been of a "make or break" variety. The relationship between NSF and Interior was altered greatly by the transfer of the Sea Grant Program, the Bureau of Commercial Fisheries, and related sectors of the Bureau of Mines and Sports Fisheries and Wildlife to NOAA, and the transfer of the Federal Water Pollution Agency to the Environmental Protection Agency. Arrangements between OSG activity and DI interests now exist with individual bureaus of the department rather than with the department as a whole.

1. Bureau of Sports Fisheries and Wildlife

There has been some interaction with the Bureau of Sports Fisheries and Wildlife (BSF&W), particularly when the legal, economic, and technical aspects of sport fishing are included in institutional proposals. Review of proposals by BSF&W personnel is not sought frequently, but the Bureau staff from Ann Arbor continues to collaborate regularly on reviews and site visits connected with Sea Grant programs for the Great Lakes.

A new era of cooperation with BSF&W has now started in connection with development of a NOAA Aquaculture Program. F. Eugene Hester of BSF&W was a participant in the 2-day aquaculture workshop held on January 29 and 30, 1973. Harold Goodwin began discussions with him about utilization of some of the Bureau facilities. The details remain to be worked out, but the atmosphere for cooperation is extremely good, and valuable joint projects should result.

2. Bureau of Outdoor Recreation

Marine recreation technology is not prominent in the Sea Grant spectrum, mostly because of traditional lack of interest on the part of the universities. Accordingly, opportunities for interchange between the Bureau of Outdoor Recreation and OSG have been limited to contacts between grantees and regional offices (e.g., New England). The outlook for a change in relations is not sanguine, but a significant expansion in this sector of marine technology is expected.

3. Bureau of Reclamation

OSG has been working closely with the Denver Office of the Bureau of Reclamation on a plan for a California undersea aqueduct. The plan was given to the University of California Sea Grant Director for use in planning his OSG program, and the Bureau of Reclamation was represented at the 1972 site visit to [illegible].

C. NATIONAL SCIENCE FOUNDATION (NSF)

[illegible] of the original connection between the Office of Sea Grant and NSF, [illegible]s with other components of NSF initially were close. Those interrelationships have, if anything, strengthened since the transfer of OSG to NOAA. This is partly owing to the continued good fortune of NSF's components as reflected by their budget trend in marine science and technology.

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1. Research Applied to National Needs (RANN)

The aquatic aspects of the Research Applied to National Needs (RANN) Program have always been closely related to Sea Grant because of their strong similarities. Enclosure (3) describes the nature of those relationships, explains how the Director and Robert Wildman of the OSG staff have interacted personally with Phillip Johnson and Richard Kolf at RANN. When Kolf and Wildman have completed their joint matrix, the identity between OSG and RANN will become even more evident. There is no duplication of effort; to the contrary, RANN has on more than one occasion rescued the Sea Grant Program from dilemmas of insufficient funds to continue meritorious programs. RANN will probably continue to do so for the foreseeable future.

RANN is particularly involved in the Chesapeake Bay program. It supports the Chesapeake Consortium which includes the Virginia Institute of Marine Sciences, the Johns Hopkins University, and the University of Maryland, each of which has aquatic programs for enhancing all aspects of the bay environment. Other RANN projects of interest to Sea Grant are: the Marine Law Program at the University of Houston that got its start under Sea Grant auspices; the Aquatic Science Programs at Oregon State University and the University of Michigan; and the Aquaculture Program at the University of Delaware. It would be difficult to identify a more useful member of Sea Grant site visit teams than Kolf, who is completely familiar with OSG programs and who has always contributed objective and knowledgeable opinions on these interdisciplinary programs.

2. Division of Environmental Sciences

Basic research in oceanography is supported by an oceanography section within the NSF Division of Environmental Sciences. Its budget has remained steady throughout the years, and the section has always been under the competent management of directors selected from within the scientific community. Interaction between Sea Grant and the NSF oceanography section has always been close, primarily because the successive section directors (e.g., Byrne, McCullen, Park, and Carpenter) were personally interested in the Sea Grant Program. They have been kept fully informed of all institutional proposals and have been major participants in many site visits. These people probably continue their activities on behalf of OSG particularly in areas where the division between fundamental and applied research in several universities is nebulous.

3. International Decade of Ocean Exploration (IDOE)

The relationship between Sea Grant and IDOE was not apparent nor particularly close at the inception of the IDOE program because the stated objectives originally diverged somewhat from those of Sea Grant.

Direction of the IDOE is very competent. Because NSF and NOAA are becoming important sponsors of marine activities, it is likely that interaction with the IDOE will become closer. For example, several projects relating to marine resources and protection of the environment are now being encompassed by the IDOE program.

4. Office for Oceanographic Facilities and Support, University National Oceanographic Laboratory System (UNOLS)

UNOLS was established to provide coordination among universities and Federal agencies in managing and operating oceanographic research vessels. So far it has proven effective. Since management sponsorship is divided between the Office of Naval Research (ONR) and NSF; the individual authority has been vested in Mary Jolarde of NSF and Ned Ostenso of ONR. Recently, these people asked if it would be possible for NOAA to contribute towards support of the coming oldie fleet in view of NOAA's charter as the "lead" marine technology agency.

Upon establishment of UNOLS in the Spring of 1972, the OSG tendered to NSF and ONR an offer to provide full fiscal support to the UNOLS staff; such support is permissible under the Sea Grant Law. Support would be an annual transfer of $90,000 from NOAA OSG to NSF UNOLS. When augmented by Sea Grant matching funds already being used for shipboard operations, this amount would stabilize OSG participation in terms of the aggregate of shipboard time actually used by Sea Grantees.

The NSF made a counter-offer that NOAA provide one-third (approximately $75,000) of the UNOLS staff support. NOAA accepted this proposal, and OSG will make the best contribution in fiscal year 1974. NOAA will be represented by OSG in future meetings of the UNOLS Advisory Council.

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Because many decisions on facilities supported by NSF are based on the total research program of an institution regardless of the source of research support, the Head of the NSF UNOLS Office frequently requests assistance from OSG in appraising an institution's need for facilities. During 1972, Arthur Alexiou of OSG participated in NSF ship facilities site visits to the University of Michigan, the University of Wisconsin, the Florida State University, and the University of Georgia.

D. DEFENSE DEPARTMENT

While in many ways Sea Grant Program operation is patterned on that of the Office of Naval Research, OSG interests are more closely allied to those of the Army because its Corps of Engineers is responsible for practical shoreline development.

1. Office of Naval Research (ONR)

Because of the expertise in the ONR section on oceanography, the OSG and ONR have often collaborated on proposal reviews. For instance, ONR Branch Office representatives from Boston and Pasadena have participated in site reviews, and ONR has invited Sea Grant participation in its site visits. For example, in 1972 Alexiou participated in the ONR site visit at Texas A&M University.

In December 1972, the OSG Director visited J. Brackett Hersey, Director of marine science and technology programs for the Office of Naval Research and Special Assistant for Marine Science to the Assistant Secretary of the Navy (R&D). The OSG purpose was to explore ways of cooperating more closely in marine science matters, particularly with respect to mutual use of individual resources. Such arrangements make for optimum use of resources—a desirable objective in these times of budgetary stress. This meeting was followed by a meeting with Ned Ostenso on January 9, 1973, and one with Hersey on January 29, 1973. Regular meetings also are held with Evelyn Pruitt of the ONR Geography Branch.

2. Naval Oceanographic Office

The U.S. Naval Oceanographic Office often has cooperated with OSG, particularly in reviewing proposals. Alexiou of the Office of Sea Grant works closely with Boyd Olson, Scientific and Technical Director of the Naval Oceanographic Office. With Olson's assistance, a number of institutional proposals are screened by Naval Oceanographic Office divisions each year. Olson participated on the 1972 site visit at the City University of New York.

3. U.S. Army Corps of Engineers

A close relationship has always existed with the Corps of Engineers. While it is not widely recognized, for two decades the Corps has had a strong program in marine technology, mainly research and development on the design and improvement of breakwaters, channel clearance, cargo handling facilities, and shoreline erosion. Liaison was established with the Corps during the first months of Sea Grant. Later, in 1967, the Corps formally established a Sea Grant Committee, consisting of eight representatives of its various divisions who might be concerned with Sea Grant activities. A formal meeting, originally coordinated by one member of the Corps, was held with the entire committee, following which communication was carried out separately.

Very few site visits have been made without the presence of at least one participant from the Corps of Engineers. Sea Grant proposals relating to shoreline processes are always cleared with the Corps of Engineers through the liaison arrangement.

Cooperation between the Corps and Sea Grant has been especially active with respect to activities in the Gulf area. At Louisiana State University, the New Orleans District of the Corps of Engineers and OSG conducted supplementary projects to examine the effect of Corps of Engineers activities on Louisiana marshland. In Mississippi, a Sea Grant project in applied oceanography has been expanded by use of supplementary funds provided by the Corps of Engineers. In South Carolina, the Sea Grant engineers at Clemson University are working hand in hand with the Corps on problems of spoil stabilization. It should also be noted that the Corps of Engineers in the New England area has cooperated fully in Sea Grant activities that were a precursor to establishment of the New England Ocean Mining Environmental Study (NOMES) program, and that the Corps of Engineers is working very closely with the University of New Hampshire on some of the University's Sea Grant projects.

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4. U.S. Navy Research & Development Command, Panama City, Florida

Sea Grant and the U.S. Navy R&D operation at Panama City developed a joint Man-in-the-Sea training program known as SITS (an acronym for Scientists in the Sea). The objective was to train working scientists in underwater research techniques. A Sea Grant was made to the Florida State University system. The activities of the University under this grant were made possible by full cooperation from the U.S. Navy, which provided facilities and equipment, and made available for the training operation SEA LAB I, the offshore platforms, and boat facilities. The program was highly successful. Unfortunately, Sea Grant does not have funds to continue its portion; consequently, the project which was due for renewal on January 1, 1973, had to be dropped. Navy cooperation, however, was excellent throughout; the senior advisor to the program on behalf of both Sea Grant and the Navy was George Bond (Captain, USN). Bond has also been extremely helpful in reviewing Man-in-the-Sea proposals outside of the Florida area. He participated in the Sea Grant site visit to Puerto Rico to determine whether the PRINUL (Puerto Rico Inter-National Undersea Laboratory) project should be funded by the Manned Undersea Science and Technology (MUS&T) and OSG offices of NOAA.

E. ENVIRONMENTAL AGENCIES

1. Environmental Protection Agency (EPA)

Sea Grant originally cooperated with the marine science project sponsors within the Federal Water Pollution Control Administration, later the Federal Water Pollution Agency. Transfer of that organization to EPA in no way diminished the coordination between the groups. Site visits to the Sea Grant institutions almost always included at least one, and sometimes more than one EPA representative. EPA representatives are helpful, with broad backgrounds in marine science and technology and useful knowledge of both Federal agency and university relationships. They have figured prominently in the institutional program assessment process.

An interesting sidelight is that the most effective reviewer from EPA, Leonard Guarraia, is a Sea Grant product; his graduate work was done at the University of North Carolina under Sea Grant auspices.

2. Council on Environmental Quality (CEQ)

In Spring of 1972, OSG was asked by the CEQ to explore the possibilities of utilizing the Sea Grant network in making studies of possible damage resulting from supertanker accidents.

Hugh McLellan of OSG directed the project and awarded appropriate grants to the University of Delaware, the State University of New York, the Louisiana State University, the Texas A&M University, and the Massachusetts Institute of Technology. A. Ahn is the official CEQ representative to Sea Grant.

McLellan currently is completing the summary report which, together with the individual studies, will be forwarded to CEQ by the end of February. Superficial assessment indicates that Sea Grant participation has resulted in reports that should contribute materially to CEQ planning in this general area.

F. DEPARTMENT OF TRANSPORTATION (DOT)

Initial contacts (in 1968) with DOT were made with the Assistant Secretary (for Plans and Policies). He was particularly interested in the possibilities of designating the Coast Guard Academy a Sea Grant College. Following our discussion, he abandoned this notion, but retained his interest in the Sea Grant Program. Further contact has since been effected through Charles Bates, who has remained close to the Program. Bates has rendered valuable advice through participation in on-site visits, and by careful and knowledgeable reviews of institutional proposals, five or six of which are sent to him each year.

G. ATOMIC ENERGY COMMISSION (AEC)

Several institutional Sea Grants relate closely to urban and suburban planning in coastal zone areas. Increasingly, within the last 2 years, such plans have had to take into account the siting of offshore nuclear power plants. This has been the cause of frequent contacts between the marine sciences section of the AEC and the Office of Sea Grant.

Charles Osterberg has acted as AEC coordinator, and AEC scientists have participated in several site visits for Sea Grant. Coordination between the AEC

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divisions of biology and medicine, reactor development, and isotope development is expected to continue, probably more closely, into the foreseeable future. Alexion of Sea Grant participated in the visit to the AEC site at the University of Miami.

Harold Goodwin of OSG and William Yee of the Oak Ridge National Laboratory are engaged in initial discussions regarding a joint project to determine the potential uses of the thermal effluents from nuclear power plants for aquaculture and other purposes.

B. OTHER AGENCIES

1. Housing and Urban Development (HUD)

During its 7 years of existence, the OSG has sought liaison with HUD on three occasions (see enclosure (1)).

2. Smithsonian Institution

One of the earliest Sea Grants was made to the Smithsonian Institution. This grant was for the design and initial conduct of a program to train taxonomic technicians, i.e., subprofessionals engaged in identifying organisms through phylum, class, and order. Since then, collaboration has been less frequent, probably, because of differences between Smithsonian and Sea Grant objectives, i.e., fundamental versus applied research.

3. Department of Agriculture

Howard Eckles and Dan Panshin of OSG are forging strong working relationships with the Agricultural Extension Services; similarities of mission operations between the programs of the two organizations make such cooperation profitable to both. This program will be reported on separately as part of the NOAA Advisory Service Progress Report.

4. Executive Office of the President

F. Gilman Blake of the Office of Science and Technology has acted as a consultant on occasion during the past two years. (Because of the recent reorganization of the Executive Office of the President, it is unlikely that a working relationship will continue.)

5. Food and Drug Administration (FDA)

Relationships with FDA have been minimal because of the small likelihood that that Sea Grant results can be applied to FDA interests. As Sea Grant moves into definitive projects on food and drugs from the sea, closer cooperation with FDA is in process. An FDA scientist assisted in the review of projects proposed under the Mississippi-Alabama program. Liaison has been established to enlist FDA cooperation in preliminary reviews of the acceptability of aquaculture-produced products, particularly when disease control drugs must be used in aquaculture, or when the organisms are cultured in thermal effluent. So far, contact with FDA has been completely informal, but formal relations will be undertaken when appropriate.

C. FIELD COOPERATION

Interagency cooperation by Sea Grant in the Washington, D.C. area is only the tip of the iceberg. Most working level cooperation takes place between Sea Grant facilities and the field offices of other agencies. For example, advisory service personnel working with fishermen and other small businessmen, call regularly on experts from the Internal Revenue Service; conduct workshops and meetings designed to assist those users of marine information. Sea Grant seafood scientists and technologists cooperate closely with FDA field offices in their efforts to assist processors to raise standards to meet new FDA regulations.

The instances of field cooperation are too numerous to cite, but the following are selected both as examples of the scope of the program. Last year, while the OSG Director was dictating his story and with a fellow passenger on a plane, he was tapped on the shoulder by a third passenger who said, "I couldn't help overhearing your discussion. I was trained in the Sea Grant curriculum at the University of Miami. Hired by the Justice Department to investigate offshore claims, and am advised that my career in this department is almost without limit. I love Sea Grant!"

Enclosure (1).

[Enclosure 1]

Mr. W. Ex. Pat., ex.

Special Assistant to the Commissioner, Office of Education, Department of Health, Education and Welfare, Washington, D.C.

DEAR MR. PURSON: This is to introduce myself as Director of the National Sea Grant Program, administered by the National Oceanic and Atmospheric Admin-

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istration of the Commerce Department. This Program was commenced and is managed under Public Law 89-688. Section 204(a) of this Act specifies that "in carrying out the provisions of this title the Foundation shall (1) consult with those experts engaged in pursuits in the various fields related to the development of marine resources and with all departments and agencies of the Federal Government (including the United States Office of Education in all matters relating to education) interested in, or affected by, activities in any such fields, . . ."

Pursuant to this Act, I have on various occasions during the past three years attempted to effect a useful liaison with the Office of Education without much success. Recently, your name was given to me as the most likely person in OOE with whom to form a useful interrelationship between our two organizations. This relationship would include, but not be limited to: examination of each others grants in marine science; assistance on on-site examinations; and joint fiscal year planning with respect to education attendant upon marine science and technology.

I am, accordingly, pleased to forward the enclosed documents relating to the National Sea Grant Program and will look forward to discussing them with you at your convenience. I can be reached on Government Code 189-2151.

Sincerely,

ROBERT B. ABEL,
Director, National Sea Grant Program.

[Enclosure 2]

DEPARTMENT OF THE INTERIOR, NATIONAL SEA GRANT PROGRAM PROPOSAL REVIEW

TITLE: IMPROVED MANAGEMENT AND UTILIZATION OF ESTUARINE RESOURCES

1. Do proposed activities duplicate efforts of your agency? If so, in what way and to what extent? No.

2. Are proposed activities consistent with the state-of-the-art? Yes.

3. Are procedures and funding appropriate for proposal objectives? Yes.

4. Are qualifications of investigator and institution adequate to conduct proposed program? Yes.

5. Suggested other reviewers: None.

6. General comment: This proposal is consistent with the provisions of PL 89-688. The VIMS is a recognized institution with considerable experience in a most important estuarine area.

The objectives are logical extensions of research carried out or in progress at VIMS and other laboratories.

7. Rate this proposal on the following scale as a contributor to development of marine resources (consider Sea Grant legislation, resource needs, existing and completed programs of your agency).

Lowest rating: [ ].

8. Approval recommended.

[Enclosure 3]

INTERFACE BETWEEN NOAA AND NSF

DR. ROBERT M. WHITE,
Administrator,

Several weeks ago I was contacted by Dr. Frank Hersman of the National Science Foundation. Dr. Hersman related that you had recently contacted the Director of the Foundation respecting NOAA NSF relationships. Apparently, the Sub-Committee on Oceanography of the House Merchant Marine and Fisheries Committee had provided the original stimulus for the meeting by inviting your opinion of the difference in functions between the Sea Grant Program and various Foundation programs (e.g., NOLS, IIOE, RANN, etc.).

As a result of your meeting, the Foundation's Director had assigned Dr. Hersman to perform a staff study and come up with appropriate recommendations. Dr. Hersman asked whether I had any ideas on how to proceed. I replied that having no prior knowledge of your meeting, I could hardly give him much substantive advice on the spot and that I would consult with you as soon as possible.

At the same time, I felt that a requisite step to any action would be an agreement between the two agencies to differentiate between Sea Grant and NSF programs in the first place. Without such an agreement I couldn't see much sense

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in proceeding further; i.e., describing the existing differences and identities and reciting nice homilies about cooperation.

The fact is that we do cooperate now, magnificently, considering the built-in constraints. I had intended to bring this up at our next private session, but the NAS NAE Advisory Committee members' remarks suggested the advisability of reporting soonest.

The attached draft is submitted for your review and action.

ROBERT B. ABEL,
Director, National Sea Grant Program.

DR. WILLIAM D. MCELROY,
Director, National Science Foundation,
Washington, D.C.

DEAR BILL: I should like further to explore a matter we discussed last month, relating to the interface between NOAA and NSF in applied marine science and technology. In view of recent congressional inquiries, I believe it would be in both our best interests to come to some agreement as to how NOAA's Sea Grant Program and the Foundation's several related programs might operate in a complementary manner.

In this view, I would like to suggest that Bob Abel, Director of my Office of Sea Grant, collaborate with your representative on a memorandum of understanding. I conceive the purpose of such a memorandum to be that of satisfying the Congress, the OMB, and both of us, that we can maintain mutually supporting, non redundant programs in marine research and development.

I would be most grateful for your comments.

Sincerely,

ROBERT M. WHITE,
Administrator.

[Enclosure 4]

HON. HAROLD B. FINGER,
Assistant Secretary for Research and Technology, Department of Housing and Urban Development, Washington, D.C.

DEAR MR. FINGER: On February 7, 1969 I had the pleasure of meeting with Dr. Richard Michaels, Director Utilities Technology, HUD, and several other representatives of the Department of Housing and Urban Development, to discuss the National Sea Grant Program and its possible implications for programs under sponsorship and or development at HUD. On March 21, 1969 I suggested to Dr. Rogers (see attached letter) possible areas of interests to both organizations.

I was recently informed that Dr. Allen Rogers Siegel has succeeded to Dr. Michaels' position and thought perhaps that it might be worthwhile to re-explore opportunities for liaison.

Should your staff be interested in further discussions, I can be reached on DI 2-5915.

Sincerely yours,

ROBERT B. ABEL,
Head, Office of Sea Grant Programs.

APRIL 23, 1973.

RELATIONS BETWEEN SEA GRANT PROGRAM ACTIVITIES AND STATE GOVERNMENTS
A DISCOURSE

As has seemed so often the case, Sea Grant-State Government relations appear to occur as a corollary or by-product of future national planning.*

In discussing the original principles of the Sea Grant Program at the time of its inception, it was apparent to the staff that without State Government support the Program could be accused before it could attain cruising speed, owing to its reliance upon matching funds. We never deluded ourselves that matching funds would be provided in quantity from industry, foundations, or other private sources.

Further, if the Sea Grant Program was to parallel the Land Grant Program activity, it would be public-oriented and would be accomplished mainly in State universities. When the president or a chancellor of a State univer-

*Orientation to industry, emphasis on coastal zone activities, dedication to interdisciplinary programs and projects.

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sity seeks matching funds, he would naturally address his sponsor, the State government.

Accordingly, by agreement among the first grantees, our Advisory Panel, and ourselves, we contacted State governments and tried to convince them of the merits of the Sea Grant concept.

More often than not, initiative was stimulated locally rather than by Washington. Some of the State governments, or particular State agencies, readily grasped the concept and its potential, and, in several instances, the State agencies approached the National Sea Grant Office rather than vice versa. This mode of operation has twin benefits. Not only is it more likely to result in production of matching funds but the State agencies are, after all, mission oriented and more in the Sea Grant image than most national agencies. Thus, they would almost by definition be able to provide more useful guidance than could be obtained in Washington.

The initial ideas for cooperation were hatched in a number of ways. Sometimes they were offered by a person on a governor's staff who had heard of the program and decided it would benefit his State; at other times, the initial interest seemed to emanate from the governor himself. In several cases, the initiative occurred on the Hill—i.e., a congressman, wondering why his State did not participate prominently in Sea Grant operations, would make contact with either our office or an agency in his own State.

During the first years of Sea Grant operation, the Federal-State relation appeared to be one of its most successful characteristics, since the Program appeared to offer promise of fulfilling aspirations of both State governments and the Congress. This seeming strength, however, could become a weakness when the national office is forced to level off its support and then sharply reduce the program's size. At that time, the State agencies which have, in good faith, contributed to their fund—under the assumption that they were participating in a growing program, will be left high and dry. This development, viewed against the background of the President's expressed desire for intensified Federal-State relations and his revenue-sharing plan, will appear schizophrenic to many of our State partners. (Enclosure (1) lists the State agency representatives and their agencies who occupy advisory position vis-a-vis the individual Sea Grant programs.) The rest of this discourse will treat the relation between the national office and each State government individually.

Washington State

Sea Grant activity in Washington was originated by the Assistant Vice President for Research of the University of Washington. The State government agencies were not brought in until 2 years later, when Stanley Murphy was appointed Sea Grant director. Since then, he has been able to involve the State Legislature, the Governor's Commission on Oceanography, and several State agencies. These relations have been fruitful, and representatives of those agencies participate in his external advisory panel.

With the help of the State agencies, Murphy has been able to involve five other public colleges in his program, particularly in the education and training phase. The State of Washington last year contributed $524,500 to the Sea Grant Program.

Alaska

David Hull, Sea Grant Director for the University of Alaska's program, was formerly a representative of a Federal agency prior to his present position. Governor Egan of Alaska will preside at a special symposium featuring Sea Grant activities in Alaska.

Hawaii

In Hawaii, John Craven, who personally oversees the Sea Grant Program, is now Special Assistant for Marine Sciences to Governor Burns. The Governor has taken a personal interest in the Sea Grant Program since its inception and, in Hawaii, State support and direct legislative appropriations amounted to $700,000 for the Sea Grant Program last year. The State Department of Planning and Economic Development and the State Office of Environmental Quality Control are represented on the Hawaii Sea Grant Advisory Council. There is a reasonably direct relation between the University Sea Grant staff and the Governor's senior Secretary.

Oregon

Governor McCall of Oregon took a personal interest in the Sea Grant Program immediately upon its inception. He may have been stimulated from somewhere

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in the University. My first visit to Oregon during the Program's initial phase was capped by a long conversation with the Governor, followed by an intensive review session with a group he had formed specifically to advise him on Sea Grant.

The Oregon Legislature was the first State legislature to initiate a direct appropriation for the Sea Grant Program. A year later, Governor McCall stated publicly that the only component of his entire budget not reduced by the Legislature was the Sea Grant Program matching fund element. In fact, this element never has been reduced by that Legislature, which has consistently provided the dollars to match the national allotment. This has been one of the solid strengths in the Oregon State program. The Governor's Oceanographic Committee is still active as a cooperating agency with Oregon State's program, as are the Oregon Fish Commission and the Oregon Game Commission.

5. California

California's Sea Grant Program is complicated. California was the first State to encompass two institutional programs—one public and one private. If anything, it could be stated that the relationships between the Sea Grant Program and the State government complex are almost too close, as will presently be explained. The first entity of the State to observe the Sea Grant Program and take notice thereof was the Coordinating Committee for Marine and Coastal Resources, one of the first (now one of many) intra-State committees of its kind in the United States. It formed a special subpanel to study the concept of Sea Grant and to relate it to State needs. The report of the subpanel has been useful in guiding the Sea Grant in the State. The Coordinating Council for Higher Education then intervened, declaring itself to be the instrument of State government that should have sole responsibility for guilding the Sea Grant Program. It suggested further that it should have the right of review on all proposals originating within the State of California before they arrive at the Washington office, in order to guide the national program in its disposition of money to groups in California. This action caused some confusion.

Shortly thereafter, the President of the State University System announced that henceforth the entire university system of California would become a single Sea Grant institution and that the University of California, San Diego (Scripps) would act as lead agent for the university system. In effect, the proposal emanating from the Scripps Institution of Oceanography would embody the combined aims and aspirations, with respect to the Sea Grant Program, of all the campuses of the Universities of California. This would include anything having to do with practical development in the marine and coastal environment. This might have thrown sand in the gears had it not been for the extraordinary coordinative skill of George Shor, who was designated as operational director.

In the meantime, the Director of the Department of Navigation and Ocean Development was charged with the responsibility for spearheading a Statewide development plan for its coastal resources, in this, he received the assistance of the Sea Grant Program of the University of Southern California. He was involved in conveying the message from the State's universities to the State government in order to obtain their matching funds.

6. Texas

One of the strengths of the Texas A&M Sea Grant Program relates to its strenuous effort to involve State government in all its activities and to recognize the State as one of the major consumers of the Program's services and products. The principal vehicle through which Texas A&M implemented this doctrine was a series of nine workshops, each involving some particular sector of offshore or coastal zone activity, to which many influential individuals in the State were invited. The workshops culminated in the series of excellent reports that are still being disseminated as models upon which we hope several other Sea Grant Colleges and institutional programs will build intra-State relationships.

One of the participants in the Texas A&M Sea Grant Program has been the Office of the Governor itself; specifically, the Sea Grant Program assisted the Governor in designing, implementing, and printing his report on coastal zone activities in the State of Texas. Two of the major links between the Program and the State are the reports: *Economic Impact of Coastal Zone Activities in the State of Texas* and *Texas and the Gulf Coast*. In carrying out its program, Texas A&M has succeeded in involving all State agencies having anything to do with offshore and coastal zone activities.

On the other hand, owing to the unusual power of the Legislature vis-a-vis that of the Governor of Texas, several of the more dominant persons in Texas coastal zone policy have been members of the Legislature.

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Texas was the first State to sponsor a Governor's Conference on Marine Affairs. Last year, the Texas State Legislature allocated $200,000 for the Texas A&M Sea Grant Program.

7. *Louisiana*

Last year, the Louisiana State Legislature appropriated $225,000 for that State's Sea Grant Program. According to our informants, this was the first time the Legislature had ever appropriated funds directly for any program in science and technology. Note: The Louisiana State University Law School, through its Sea Grant Program participation, has been influential in drafting nearly all that State's coastal zone legislation.

8. *Michigan*

One of the reported weaknesses of Michigan's program was the apparent tenuousness of its link to State government, but a marked change has taken place during the last year. This change was best exemplified by the Michigan House of Representatives Concurrent Resolution No. 376. This Resolution stated: ". . . Resolved, that the Legislature and the various agencies give serious consideration to providing financial support to the Michigan Sea Grant Program in those areas where research will help protect and advance the general Great Lakes environment." This Resolution was adopted by the Michigan House of Representatives on February 3, 1972, and by their Senate on March 1, 1972.

At the last Sea Grant site visit, James Kellogg, Executive Assistant to the Governor of Michigan, participated in all phases of the site review sessions, speaking strongly in behalf of the Sea Grant Program. He assured the site visit team that the State was sincerely interested in the Sea Grant Program but, up until that time, had simply been too impoverished to give much more than moral support to the Program. He made further representation on the Governor's behalf in Washington, D.C., to support the Sea Grant Program at the University of Michigan. We are advised that this year the State Legislature will appropriate funds directly for the program, unless the program's reduction is sufficient to deter them. The Governor of Michigan has recently announced his designation of the University of Michigan's Sea Grant Program as the official State Coastal Zone Management Agent.

9. *Florida*

The first major grant in Florida was a project grant in FY 68 to the University of Miami, a private university. Previously, a small grant for education had been awarded to Florida Atlantic University, a State institution. For 4 years, however, the University of Miami's program dominated Sea Grant activities in that State. The University attempted to establish relation with State government but had to combat a tradition of unwillingness by State government to subsidize private schools. According to University President Stanford, the only instance in which the State had given funds to the University was for its medical program, and this was to meet an intense need. The State government presently has no representatives on the Board of Sea Grant Counselors of the University of Miami.

In 1970, however, the State of Florida passed a bill establishing a Coastal Zone Coordinating Council with a permanent staff directed by Bruce Johnson, who collaborated with the University of Miami and participated in the most recent Sea Grant site visit to that University.

Concurrently, during the period 1967–70, the State university system had made several overtures to the Sea Grant Office in Washington. The spearhead of the Florida plan was the State Board of Regents, which had established an Office of Oceanology intended to coordinate all aquatic science and technology in the State of Florida. Practical cooperation was slow in coming until the State system components agreed in 1971 to recognize Hugh Popenoe as the State system coordinator for the Sea Grant Program. His first effort was a collaborative plan between the Florida State University of Tallahassee and the University of Florida at Gainesville. This was an excellent plan resulting in what was, for that time (1972), a fairly large coherent grant. His current program also encompasses the activities in the University of West Florida (Pensacola), University of South Florida (Tampa), and Florida Atlantic University (Boca Raton). The Coastal Coordinating Council is represented on his advisory board. The unfortunate coincidence of Statewide agreement for close cooperation and the sharp reduction in Sea Grant funds may prove detrimental to future planning in that State. We hope otherwise.

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D. Delaware

Sea Grant had a unique origin in the State of Delaware—from a triumvirate consisting of Governor Terry, President Trabant of the University, and Henry DuPont, Chairman of the Board of the DuPont Corporation. The Program's fast start in this State was greatly assisted by Henry DuPont's personal interest and helpfulness with matching funds.

Soon after the initial conference in 1968, the governorship had changed hands, and the new Governor (Peterson) commissioned a special task team headed by James H. Wakelin, Jr., to make a thorough survey of aquatic technology activities in the State of Delaware and indicate the areas of opportunity. The task force worked closely with the Sea Grant staff at the University of Delaware and with the State agencies. Today, there is probably no Sea Grant Program more closely connected with the State agencies than that of the University of Delaware. The advisory committee now includes: Secretary of the State Department of Natural Resources and Environmental Control, Secretary of the State Department of Industrial Development, Director of Transportation of the State Department of Transportation, Chairman of the State Coastal Zone Industry Control Board, and Chairman of the State Delaware Bay Oil Transportation Committee.

Consequently, that University's annual proposal closely reflects needs and opportunities in the State of Delaware with particular emphasis upon its coastal zone. Although the State of Delaware has not as yet appropriated funds directly for Sea Grant, the University last year contributed $314,683 in matching funds.

E. Massachusetts

Although State government relations in Massachusetts are of recent origin, they are quite strong in that a State agency is a Sea Grantee. The Department of Natural Resources of the State of Massachusetts is a third participant in a program, the other participants of which are the University of New Hampshire and the Raytheon Corporation in Rhode Island. This team offers the unusual image of the public universities of 2 States, and an industry of a third State, operating as full partners under a single Federal technical program.

The Sea Grant Program first came to the attention of then Governor Volpe at a luncheon in 1968, while he was commissioning a Statewide task force for marine science. Although he expressed his interest in the program at the time, the only Sea Grant activity in the State was a single project funded by an educational grant to the Massachusetts Institute of Technology. Since then, that grant has enlarged through coherent project status into a full-scale institutional grant. A Sea Grant Advisory Council reports to the Director of their Sea Grant Program who is the Dean of Engineering at MIT; he in turn, reports to the Provost of the Institute. The State of Massachusetts enjoys close links with the University at a policy-making level.

In 1971, following disclosure of the possibilities of petroleum exploration and development on the New England Continental Shelf, the New England River Basins Commission and the New England Regional Commission asked the Massachusetts Institute of Technology to investigate the problems that might arise from development of any large finds. As a result, the two Commissions and the MIT Sea Grant Program prepared a joint proposal to the National Sea Grant Program for additional support for a yearlong study. The study was completed, and the findings were presented to the State sponsors and others interested in a public, day long meeting in March 1973, at the Institute. In retrospect, this is one of the clearest instances of Sea Grant State and Federal governments cooperation in a program of clearly identified need with quick response.

F. North Carolina

The North Carolina Sea Grant Program was stimulated deliberately by the Sea Grant Office in Washington. After 2 years of program development, it was noted that all the activity on the east coast appeared to be centered in the New York—New England area and in Florida, with a major gap existing in between. Congressman Alton Lennon, then Chairman of the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries, which has jurisdiction over the Sea Grant Program, was approached for assistance. He contacted the State of North Carolina and then introduced us to Wayne Corpening who began moving fast. Following an invitation from Governor Dan Moore, a North Carolina Sea Grant Program was conceived and planned in the Governor's dining room with the Governor, assisted by members of his staff and the heads of State agencies.

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At the same time, Governor Moore established the North Carolina Marine Sciences Council to advise the State on the policy level with respect to problems and opportunities in its coastal zone.

Each year, the Governor arranges State funds to match the Sea Grant award; last year, on his instruction, the State appropriated $355,000 for this program.

13. Wisconsin

A motto of the University of Wisconsin has always been "The State is our campus." The University has traditionally acted as a servant of the State, tuned to State requirements, and has been active in education and technology according to State needs. That University has sought to incorporate the Sea Grant Program into this tradition, and has recently done so with considerable success. Each year, the University's Sea Grant Program sponsors a Statewide conference to bring the Sea Grant activities to the attention of State representatives, industrialists, and other university personnel, for the purpose of introducing dialog and broader participation into the system.

During the past 2 years, Governor Patrick Lucey has participated personally in some of the Sea Grant affairs such as opening the conferences. Wisconsin is another State wherein funds are appropriated directly by the Legislature. Last year, $600,000 was appropriated for the Sea Grant Program.

14. New York

The first Sea Grant in the State of New York was awarded in FY 68 to the Lamont-Doherty Observatory of Columbia University for a program that eventually developed into a project at St. Croix to study deep upwelling. The State University of New York system, with Cornell University, applied relatively late in the Program's recent history but, when it did, it came on in a big way. The State University of New York applied for an institutional grant as a State system, its first program application in FY 72 encompassing over a dozen universities in the system.

The program was originally coordinated under the leadership of SUNY Stony Brook; however, the Sea Grant Director moved his headquarters to Albany to be more securely integrated with the State government structure. The SUNY Program is exceptionally well planned and coordinated, attesting to the feasibility of several universities and colleges cooperating in a single technology program. The Marine Advisory Council for that program comprises mostly industrial persons but includes representatives from the Long Island Environmental Council, the Port of New York Authority, the New York State Department of Environmental Conservation, and the Nassau-Suffolk Regional Planning Board. While the matching funds for New York's program were applied directly by the universities themselves with their State money, this year, for the first time, we have learned that the State Legislature has appropriated funds directly identified as Sea Grant matching funds. Recently, the Sea Grant Director, Donald Squires, has had frequent communication with State representatives at all levels.

15. Rhode Island

The Governor of Rhode Island was the first Governor to designate a State University as Coastal Zone Management Agent. The coastal zone management program of that State is staffed by the Sea Grant directorate of the University of Rhode Island. The relations between the Sea Grant Program and State government have been particularly close, possibly owing to the preeminence of the University as the principal State educational organization in Rhode Island. Nelson Marshall of the Rhode Island Sea Program is the officially designated State Coordinator for coastal zone programs.

The State Legislature does not appropriate funds specifically for the Sea Grant Program since the University's budget is not broken down by line item. The University of Rhode Island was one of the four original Sea Grant Colleges.

Beyond the coastal zone designation, etc., working relations between State agency and university did not appear particularly close over the years. However, a growing consciousness relationship between State needs and university Sea Grant projects has been sparked by the Sea Grant concept.

16. New Hampshire-Maine

In 1967, the Governors of Maine and New Hampshire, assisted by their staffs and presidents of the universities in both States and many of the industries in both States, attended a ceremony wherein they signed an agreement pledging to develop a bi-State, cooperative oceanographic program. The Director of

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the National Sea Grant Program was principal speaker, since the Sea Grant Program had provided the impetus for the agreement and events leading up to it.

For want of adequate funding and other reasons, the bi-State arrangement disintegrated over the next 5 years and revived late in 1972. Governor King of New Hampshire appeared to be the prime mover, his motive apparently being the desire to use the 18 miles of New Hampshire coastline as a gateway to 250 miles (directly across) of Continental Shelf. With the exception of these two arrangements, the proposals and projects in the States of New Hampshire and Maine have not exemplified very close coordination with the State governments.

The National Sea Grant Program also supports a marine advisory service program in Maine. This is carried out by the Marine Department of Sea and Shore Fisheries, which is a State agency.

It is possible that impending developments between the two States will draw the State agencies more closely into their Sea Grant programs.

17. Mississippi Alabama

Mississippi and Alabama represent the second instance of a bi-State Sea Grant development. In 1972, a ceremony was held in Biloxi, Miss., at which the Governors of Mississippi and Alabama, national and State representatives, head of agencies, and presidents of all the academic institutions, subscribed to a bi-State Sea Grant Program involving 10 major universities in both States, including public and private, coastal and inland, and black majority and white majority. This was a precedent-shattering episode in the histories of the two States and was given attention at the highest level of government when President Nixon delegated his Special Counsel, Harry Dent, to give the keynote speech.

Among other things, Dent declared that ". . . . the President is aware of the Program and wants to see it grow. . . ." While the administrative and diplomatic implications of this event are obvious, its technological import and impact upon the two States' coastlines are at least as significant. In this light, it seems particularly unfortunate that the Sea Grant Program, failing to receive enough funds to carry on normally, was forced to deprive the Program in Mississippi of enough funds to maintain its relationship with Alabama. Consequently, the Sea Grant Program in Alabama will have to wait until some later year for commencement.

The Sea Grant Program in Mississippi has had the Governor's personal attention from its beginning. The Sea Grant Program in Mississippi has, in a macabre way, an unusual opportunity to provide for clear guidance in that the State's coastline was wiped clean a few years ago by Hurricane Camille. Accordingly, all the State Sea Grant planning has been very closely allied to the State's needs for redevelopment of the coastline in the most efficient and useful manner possible.

18. Virginia

The Virginia Sea Grant Program is unusual in that a State agency and the university program are in residence; i.e., the Sea Grant Director, William G. Hargis, Jr., is also an agent of State government. The Virginia Institute for Marine Sciences (VIMS) can participate as an academic institution in that it has a degree-awarding arrangement with the University of Virginia and William and Mary, and it also acts as a State laboratory, giving Hargis unusual flexibility.

In matters relating to marine science, Hargis normally speaks for the State. The Sea Grant Office, however, has been apprised of several occasions of disagreement in some corners of the State of Virginia, owing to a resentment on the part of certain other universities over Hargis' authority.

19. South Carolina

The South Carolina Sea Grant Program was conceived and developed in the image of Virginia's, owing to the dominant influence of William Hargis in South Carolina marine affairs as a trusted adviser and because of the designation of Hargis' former assistant, James Joseph, as the South Carolina Sea Grant Coordinator. Accordingly, the development of State interest in this program has been patterned somewhat after that of Virginia. Specifically, Sea Grant in South Carolina is coordinated by the State Wildlife and Marine Resources Department. Yet, operating within this apparent restriction, the coordinating staff has been successful in involving the entire university system of South Carolina in the program, including Clemson University, the Medical College of South Carolina, and Charleston College, in addition to the University of South Carolina itself.

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SUMMARY

In broad aspect, it appears that Sea Grant has been at least as successful as any other Federal program in capturing the attention of State governments and their representatives, and in developing a collaborative spirit between State agencies, universities and colleges (including both public and private), and industry. It is within the doctrine of the national program to foster this cooperative spirit and to encourage its diffusion through all relevant State agencies and into States where such affiliations do not now exist.

This report has deliberately omitted references to congressional interests, since congressional contacts have been many and varied, and they are felt to be beyond the scope of the present discussion. Moreover, in discussing Executive Legislative relations with respect to Sea Grant, it is difficult to separate relations on a national level from those pertaining to State interests, nor would this Office have any desire to do so. In relaying the sense of the recent budget reductions to our Sea Grant Directors, and through them to the various State agency associates, we have attempted as much as possible to maintain a sense of temporariness of all our current fiscal dilemma. In the hope that State government cooperation, especially its matching fund activity, will not be "frightened off." In this view, we have been especially encouraged by the attitude of Alabama, which has desired of itself as having sufficient faith in the Sea Grant concept so that it is able to carry on alone for the next year or two until Sea Grant progress is restored to its former status.

Enclosure 1.

Initial planning for the program took place in Governor West's home where initial arrangements were discussed and possibilities for supervisory personnel explored. The coordinating and headquarters staff is housed in the State Marine Laboratory at Charleston. The Sea Grant Coordinator reports to the Director of the Marine Resources Division who, in turn, reports to the Director of the State Wildlife and Marine Resources Department. He, in turn, reports directly to Governor West.

Despite the apparent subordination of academia to State government, the program appears to be progressing at least as well as those in other States which are supervised by academia and better than some. The State orientation was apparent in the first proposal submitted by the Sea Grant system last year, wherein it was noted that the plans and aspirations expressed in the Sea Grant proposal were well attuned to needs of the people and opportunities for State government to meet them.

2c. Other States

Sea Grant projects operate in the States of Connecticut, Maryland, New Jersey, and Georgia. These projects are being carried out either singly or under a Sea Grant coherent conduct program. In none of these four States are there discernible links between the project supervisors and State governments, although State representatives in each of these States have expressed interest in the Sea Grant Program at one time or another. Of the four, the program in Georgia offers the best promise of developing into full institutional status at the moment.

(Enclosure 1)

STATE AGENCY REPRESENTATIVES SEA GRANT PROGRAMS

Alaska: University of Alaska: James Brooks, Commissioner, Alaska Department of Fish and Game.

California

University of California San Diego: Roy Arnett, California Department of Fish and Game; John Bennett, California Department of Navigation and Ocean Development.

California State University Humboldt: Ron Warner, California Department of Fish and Game.

University of Southern California: T. R. Gillenwaters, California Ocean and Navigation Commission; Victor Adorian, California Department of Real Estate Management; Ari Haagen Smit, Chairman, California Resources Control Board; John Tooker, Director, California State Office of Research; John Bennett, California Department of Navigation and Ocean Development; Robert Kruger, Chairman, Comprehensive Ocean Area Plan; Janet Cobb, Environmental Matters, State Attorney General's Office; Carl Baginsky, Coastal Matters, State Attorney General's Office; Ernie Greenwood, California Department of Fish and Game.

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Delaware

University of Delaware: William J. Miller, Director, Delaware River and Bay Authority; David Hugg, III, Comprehensive Planning, Delaware State Planning Office; Richard L. Murchison, Director, Division of Economic Development, Delaware State Planning Office.

Florida

University of Florida System: Fred Bariega, Florida Coastal Coordinating Council, Department of Natural Resources; H. Robert Graham, State Senator; Ney Landrum, Director, Division of Recreation and Parks, Department of Natural Resources; Harmon Shields, Chief, Division of Marine Resources, Department of Natural Resources.

Georgia

University of Georgia: Joe D. Tanner, Commissioner, Georgia Department of Natural Resources; David M. Gould, Supervisor, Coastal Fisheries Section; William W. Anderson, Chief, Coastal Fisheries Research and Development; Jack A. Crockford, Director, Game and Fish Division, Department of Natural Resources; Sam Pickering, Director, Earth and Water Division, Georgia Department of Natural Resources; Paul C. Pritchard, Program Coordinator, Resource Planning Section, Georgia Department of Natural Resources.

Hawaii

University of Hawaii: Richard E. Marland, Interim Director, Hawaii Office of Environmental Quality Control; Andrew Gomes, Director, Development Division, Hawaii Department of Planning and Economic Development.

Louisiana

Louisiana State University; Lyle St. Amant, Assist. Director, Louisiana Wild Life and Fisheries Commissioner; Ellen B. Moore, Register of State Lands; Ory Poret, Deputy Register of State Lands; Senator Samuel B. Nunez, Chairman, Joint Legislative Council on Environmental Quality; Donald A. Whittinghill, Executive Secretary, Joint Legislative Council on Environmental Quality; Clint Pray, Chairman, Governor's Council on Environmental Quality; Kelly Nix, Special Assistant to Governor and Federal Aid Coordinator; William Guste, Attorney General; Richard Troy, Assistant Attorney General, Environmental Section; P. J. Mills, Executive Director, Louisiana Deep Draft Harbor and Terminal Authority; John Trygg, Director, Bureau of Environmental Health.

Maine

University of Maine; Spencer Appollonio, Commissioner, Maine Department of Sea and Shore Fisheries; Robert L. Daw, Maine Department of Sea and Shore Fisheries; Ron Poitras, State Planning Office; Gary Higgenbottom, State Planning Office.

Massachusetts

Massachusetts Institution of Technology; Thomas L. Adams, Secretary, Communities and Development, the Commonwealth of Massachusetts; Arthur W. Brownell, Commissioner, Department of Natural Resources, the Commonwealth of Massachusetts; William M. Bulger, State Senator.

Michigan

University of Michigan; Thomas J. Anderson, Representative, State of Michigan; Joseph Cook, Economic Expansion Division, Department of Commerce, State of Michigan; James Kellogg, Executive Assistant to the Governor, State of Michigan; Ralph W. Purdy, Executive Secretary, Water Resources Commission, State of Michigan; Raymond J. Spoit, Representative, State of Michigan; Stanford Smith, Bureau of Sport Fisheries and Wildlife Laboratory.

Mississippi

University Marine Center; Gerald Blessey, State Representative; Thomas Golbott, State Representative.

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New Hampshire—

University of New Hampshire; Shepherd Bingham, Assistant to Majority Leader, New Hampshire Legislature; A. Dickson Smith, Executive Director, New Hampshire State Port Authority; George Hamilton, Director, New Hampshire Division of Parks and Recreation; Robert Dow, Director of Research, Maine Sea and Shore Fisheries; Spencer Apollonio, Commissioner, Maine Sea and Shore Fisheries; Richard Seamens, Jr., Chief Marine and Fish Water Fisheries, New Hampshire Fish and Game Department; Larry Stolte, Fisheries Biologist, New Hampshire Fish and Game Department; B. E. Barrett, Director, Marine Research, New Hampshire Fish and Game Department; Mary Louise Hancock, Director, New Hampshire State Planning Office; E. Rogers Rutter, New Hampshire State Planning Office; Charles Tucker, Director, Southeastern New Hampshire Regional Planning Commission.

New York

State University of New York; Mason Lawrence Department Commissioner, New York State Department of Environmental Conservation; George Humphreys, Assistant Commissioner, New York State Department of Environmental Conservation.

North Carolina—

University of North Carolina; Ronald Scott, State Planning Officer; Roy Sowers, Director, State Department of Conservation and Development; Carroll L. Mann, Jr., State Property Officer; George E. Pickett, Director, State Department of Water and Air Resources; James W. David, Director, State Ports Authority; Jacob Koomen, State Health Officer.

Oregon —

Oregon State University; Eugene Kruse, Acting Director, Fish Commission of Oregon; Wallace Hublou, Director of Research, Fish Commission of Oregon; John McKean, Director, Oregon State Game Commission; John Rayner, Director of Research, Oregon State Game Commission.

Rhode Island—

University of Rhode Island; Daniel Varin, Director, State-Wide Planning Agency; John L. Lyons, Chairman, R. I. Coastal Zone Management Council; John Cronan, Deputy Chief, Fish and Wildlife.

Texas

Texas A&M University; Robert L. Armstrong, Land Commissioner; Frank Hildebrand, Exec. Director, Texas Tourist Development Agency; Joe C. Moseley, Executive Director, Texas Council on Marine-Related Affairs; Joe B. Harris, Coordinator, Natural Resources, Governor's Office, Division of Planning Coordination; Terrance Leary, Coastal Fisheries Division, Texas Parks and Wildlife Department.

Washington

University of Washington; Cedric E. Lindsay, Assistant Chief, Management and Research, Department of Fisheries; Ralph A. Beswick, Supervisor, Surveys and Marine Land Management, Department of Natural Resources; Griffith C. Evans, Jr., Executive Secretary, Oceanographic Commission of Washington.

Wisconsin

University of Wisconsin; Farnum Alston, Assistant to the Governor, Harold Jordahl, Member (Governing) Board, Department of Natural Resources; Thomas Frangos, Director, Environmental Protection Division, Department of Natural Resources; Ron Poff, Director, Great Lakes Fisheries Division, Department of Natural Resources; Roger Schrantz, Deputy Director, Bureau of Planning and Budget, Department of Administration; E. Jack Schoop, Assistant Director for Planning and Budget, Department of Administration.

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(The following information was referred to on p. 29:)

A SAMPLING OF SEA GRANT SUCCESSES

TEN CASE HISTORIES

1. Aquaculture, Salmon

Aquaculture is one of the few fields specifically noted for Sea Grant emphasis in Public Law 89-688. Among the several successes in aquaculture research is a Sea Grant project that turned research into commercial production of pan-size salmon. The research was conducted by the National Marine Fisheries Service at Seattle, and demonstrated the feasibility of net culture of salmon to individual-portion size. A Sea Grant to Domsea Farms, Inc., made through National Marine Fisheries Service, brought the research to commercial pilot scale and permitted marketing and processing studies in addition to further technical research. As a result, Domsea has gone into business in Puget Sound. The first Maine harvest of pan-size salmon, a spin-off from the Sea Grant, has been made by Callahan Mining Company. Application of the technology in Great Bay, New Hampshire is underway. At last report, fifteen requests for leases had been made to the State of Washington for salmon production in Puget Sound alone.

2. Aquaculture, seaweeds

Production of the marine colloids, carrageenan and algin, is a small but key industry in the United States, with over 500 different industrial uses for the colloid products, many in processed foods. The industry has depended on natural stocks but with increasing demand for the colloids, the supply of natural seaweeds is insufficient. Sea Grant has sponsored a project at California Institute of Technology, with joint funding from the state and industry, to restore decimated kelp beds off California. Kelp is the principal source of algin. The project has been so successful that attempts now are underway to plant completely new kelp beds and so increase the supply. A red seaweed, *Eucheuma*, is the source of a very important fraction of carrageenan necessary to the processing of such foods as "snapopack" desserts. Under a University of Hawaii Sea Grant College project, successful farming of the red seaweed has been demonstrated and is now underway in the Philippines, with the product purchased by an American firm which helped to support the research through provision of matching funds. The next step is to develop seaweed farms in American flag areas, particularly in the Trust Territories, and in Florida waters.

3. Marine Resources, coral

The worldwide precious coral industry has depended primarily on the Okinawan coral fishery. Under a Sea Grant at the University of Hawaii, beds of precious pink coral were found in the Islands, and a new gem species, gold coral, was introduced to the industry. Through industry cooperation, the feasibility of harvesting coral with a specially equipped submersible was demonstrated. As a result, the Hawaii precious coral industry can now look to local stock rather than depending fully on imported coral, and has a new product to jet on the market. National Marine Fisheries Service is working on guidelines and regulations to protect the resource from over-harvest.

4. Marine Resources, fisheries

Eels abound, but are not consumed to any great extent in the United States. On the other hand, there is a large European market. Sea Grantees in North Carolina have aided development of an eel fishery for export by improving methods of harvesting, holding, purging, and processing the eels. As a result, a harvest of a quarter of a million pounds of eel for export to Europe is projected for 1973 with a return to North Carolina fisherman of $75,000. As a side benefit, Sea Grant arranged with a North Carolina workshop for handicapped persons to build eel traps for sale to the fisherman. The project personnel also found for the fisherman a processor-broker who would buy and export the eels.

5. Marine Resources, sand and gravel

Because of zoning, environmental considerations, and supply depletion, more and more coastal states are turning to the marine environment for supplies of sand and gravel. Sea Grant initiatives, principally through a project combining the Raytheon Corporation and the University of New Hampshire, sparked the NOMES project (National Ocean Mining Environmental Study) to determine the environmental effect of offshore mining of aggregates. To illustrate the importance of the source, the University of Rochester has conducted a Sea Grant

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project which identified three large and two moderate-sized sand and gravel deposits in Lake Ontario. Two companies have obtained mining permits and others have applied. One deposit, at the mouth of the Niagara River, has an estimated worth of from 90 to 150 million dollars. Similarly, the University of Hawaii has located offshore sand and gravel deposits containing at least a total of four and a half million cubic yards of material.

6, Coastal Zone Management Research

The University of Rhode Island, a Sea Grant College which has been designated by the Governor as the State's Coastal Zone Laboratory, developed a method of biological and physical monitoring of Narragansett Bay, and a computer model through which State managers can predict the effect of various decisions before they are made. The techniques are transferable to other geographic areas.

7, Socio-Economic Studies, seafood marketing

Merchandizing of seafood products has not been competitive with merchandizing of meats and poultry because of outdated marketing methods. Texas A & M Sea Grant College made a pilot study of seafood distribution and merchandizing activities in the Gulf region, and developed new merchandizing strategies and management techniques. The plan was tested in a supermarket and increased average weekly volume of total seafood sold by 84%, boosted dollar sales volume 80%, and increased average weekly profit 152%. Over 10 retailers have asked for information on the Texas A & M plan, and the investigators are holding workshops for interested seafood marketers.

8, Sea Grant Legal Activity

The most publicized aspect of Sea Grant legal research is the international law of the sea; but, specific, less well known activities are in direct support of local industries. An outstanding example is the University of Oregon legal handbook for fishermen, detailing, in language understandable to the average fisherman, his rights, responsibilities, and limitations under the law. The Oregon handbook, prepared in draft form to obtain feedback from fishermen, covers such factors as insurance and loans in addition to Federal and State regulations. The Oregon law project is part of the Oregon State Sea Grant College program.

9, Sea Grant Education and Training

Overall, the Sea Grant record of graduate placement has been better than 95% of those going into the job market on graduation. An outstanding case, because it fills a special need, is the Mississippi State Institute of Engineering Technology project to train baccalaureate-level engineers specifically geared for the shipbuilding industry. This program was developed in conjunction with the shipbuilding and service industry, and several companies have either paid tuition for promising students or have offered summer work projects. The record of job placement is 100% for those seeking work upon graduation, with starting salaries in excess of $800.00 a month for all, and salaries of over $1000.00 a month for the top students.

10, Advisory Services, fisheries

Sea herring move offshore away from Rhode Island in early winter, and the State herring fishery ceased because it was uneconomical to fish with a single boat pelagic trawl. Rhode Island Sea Grant College advisory service personnel recommended the use of a two vessel trawl, and brought an expert from abroad to demonstrate the system. Several boats of the Point Judith fleet have adopted the technique, and as of the last reporting date, in January, 1973—with the new technique only three months old, over six million pounds of herring had been caught, with a landed value of $120,000—which happens to be exactly 50 times the cost to Sea Grant Advisory Services.

Senator PELL. We move on to our next witness, the Chairman of the Advisory Committee Panel—Dr. Atwood.

STATEMENT OF DR. SANFORD S. ATWOOD, PRESIDENT, EMORY UNIVERSITY, ATLANTA, GA., CHAIRMAN, NATIONAL SEA GRANT ADVISORY PANEL

Dr. ATWOOD. Mr. Chairman, let me identify myself. I am currently president of Emory University. It is a pleasure to be here before

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your committee and to assess the national sea grant program. Although I am president of a privately endowed, gift-supported university, I appear today primarily as the Chairman of the Sea Grant Policy Advisory Panel, a position which I have held since the program's inception.

It may also be of interest that as former provost of Cornell University, and as a former employee of the U.S. Department of Agriculture, I was actively involved in this country's land-grant program. This experience has given me a novel and, I hope, advantageous point from which to evaluate the progress of the sea grant program.

Since our Panel is concerned more with policy formation than with its day to-day execution, and since the program's management was discussed by those who preceded me, I would like to confine my remarks to the philosophy and design of the program and to a brief examination of its place in present day government, but first, a word about the Panel itself.

I have often remarked that this is one of the most unstructured and yet productive groups with which I have ever been associated. In this, we probably reflect the concept of the program itself - absolutely unconfined to conventional patterns and techniques of Federal Government administration, but devoted completely to practical and beneficial output.

At the time the Panel was first formed, as Dr. Abel mentioned, we possibly numbered among us more industrial representatives than all of the rest of the National Science Foundation advisory committees combined. This, too, reflected the essentially pragmatic nature of the program.

In this connection, Messrs. Chairmen, I would like to offer for the record a listing of the panel members and their affiliations. In this regard, I am delighted to note the announcement of our newest member of the panel, the Honorable Alton Lennon, who, as you know, served with such great distinction and dedication for so many years as the House subcommittee's chairman and who has been such a prominent statesman in the design and in the coordination of the national program in marine science and technology.

Most of the Panel members are here. I think it might be appropriate for me to call their names and have them rise as I mentioned them.

In addition to myself, Dr. George S. Benton, of Johns Hopkins University.

Dr. Lynton K. Caldwell, of Indiana University, is not with us today.

Mr. Jacob J. Dykstra, Point Judith Fishermen's Cooperative Association.

Mr. Phillip Eisenberg, president, Hydronautics, Inc., not here this morning.

Dr. J. Osborn Fuller, president of Fairleigh Dickinson University.

Dr. Joseph E. Henderson, now consultant but formely head of the Applied Physics Laboratory at the University of Washington.

Mr. Chalmer G. Kirkbride, now a consultant but formerly a vice president with the Sun Oil Corp.

Mr. Otto Klima, vice president and general manager of the General Electric Co.

Hon. Alton Lennon.

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Mr. Harold E. Lokken, president of the Fishing Vessel Owner's Association.

Dr. Athelstan F. Spilhaus, who has been mentioned already in this hearing, now with the Woodrow Wilson International Center for Scholars, and to many, the originator of Sea Grant.

Dr. H. Burr Steinbach, dean of graduate studies, Woods Hole Oceanographic Institution, formerly at the University of Chicago.

Dr. James Wakelin, Jr., chairman of the board and president of the Research Analysis Corp., and well-known to this committee.

Mr. M. Harvey Weil, of the firm of Kleberg, Mobley, Lockett & Weil in Corpus Christi, Tex.

That is the listing of the Panel. There are three ex-officio members: Dr. Douglas L. Brooks, executive director of NACOA; Dr. Roy D. Gaul of the Office of Naval Research; and Dr. David S. Potter with the General Motors Corp.

I believe that a major factor in attracting and maintaining the interest of the persons of stature, represented on this list, is the unusual opportunity afforded them of watching their suggestions and recommendations translated into real doctrine. Several of us have watched the program from its birth.

The Sea Grant Act, as passed by the Congress and approved by the administration, was an extremely broad mandate in marine science and technology. Under such a mandate sea grant could have gone in many directions. The sea grant program is fortunate to have had a steering group, as members of the Advisory Panel, comprised of persons of unusual expertise in management and in marine science and technology. It is my firm belief that without the sage counsel rendered by these gentlemen, since the inception of the program, it could have foundered in innumerable ways.

A prominent portion of our meetings concerns the staff's report on actions taken on the Panel's previous recommendations and updating of our site visits. I believe it is safe to say that our panelists' commonest personal characteristics are their outspokenness and freedom from inhibition. I say this deliberately to set the stage for some of the comments I wish to make.

Although I could hardly profess to speak for all of my colleagues on the Panel, I believe I can satisfactorily express consensus in stating our pride in the program's successes and our role therein, and our perplexity at the recent dampening in its growth curve.

I know that the panelists all approve of a common network of strong centers of marine technology, education, and public assistance through its advisory service. In this regard, we have requested the staff to revise its long range plan, previously prepared in 1969. We would like, quite naturally, to see the sea grant network completed and we, therefore, endorse the sea grant long range plan in this regard.

We will examine the revised plan, when it is completed, to insure that it is attuned to national needs and is responsive to the desires and aspirations of the Congress. While we would like to see completed the establishment of sea grant colleges and other centers of marine excellence on all or our coasts, on the Great Lakes, and bordering on major waterways, we nonetheless recognize that marine technology is but one of a manifold of national programs and must take its proper place in the ordering of Federal priorities. We believe, nevertheless,

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less, that the sea grant program is extremely important and that its benefits in education and in the development of the marine sciences and technology will be many times more than commensurate with its cost.

In support of this belief, we of the Panel want to insure that the most comprehensive and accurate possible analysis is made of the cost and the related benefits resulting from sea grant efforts in research and development, in education and training, and in marine advisory services. While we admit that it is too early to make a simple assessment of the program's value, we have seen enough results already to be convinced that the program shows every indication of bearing out its early promise. We believe that it will continue to develop the tangible results in the marine fields that this committee foresaw at the time it designed and passed the Rogers-Pell Act.

Our concern over the program's recent slowdown stems from several causes: First, this is a program planned on the basis of controlled growth. The long-range plan to which I alluded demonstrates specific and obvious financial containment and a clearly delineated plateau upon completion of the network. Growth stoppage short of this point is not in the Nation's best interest.

Second, the benefits accruing from the program's operations have already exceeded forecasts toward this point in time; I believe the sea grant office has compiled a report of these for the record.

Third, the program exemplifies, and has done so from its beginning, a great many of this administration's recent enunciations of national goals. These include doctrine for the new federalism, with a consequent shift of responsibility to the States sharing in revenues and fiscal responsibilities, relatively more concentration on local, State, and regional needs and opportunities, and a shift of technical responsibility to the local and State governments.

The program also has shown the way in initiating close industrial ties, in improving interdisciplinary activity, and above all, has refreshingly uncovered contributors to our Nation's marine science effort who had never previously been involved.

Fourth, the sea grant program is the only operating, matching fund program in marine science and technology. It follows, therefore, that reductions in this program have the effect of the Federal Government's reneging on commitments made to its financial allies. In the same vein, funds spent by other agencies for the same work have the effect of losing to the Government half the amount of their funding.

Our last major recommendation to the staff and the sea grant directors concerned the concept of a program that would involve a study of those areas in marine science and technology wherein the United States may be falling behind in foreign competition and trade in ocean related activities. This study would focus on assessing marine technology to determine what techniques, instruments, or equipment are appropriate in the field of international trade that could be useful in improving our balance of trade position. We advocated consideration of a 10-year plan to prepare the United States for future competition. I understand that the sea grant office is proposing implementation of this recommendation to the Secretary of Commerce via the NOAA Administrator. My colleagues and I believe this plan to be closely

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aligned with current national policy, and we believe sea grant capable of playing an effective role in its execution.

For these reasons, Messrs. Chairmen, my colleagues and I want to express our admiration for the way the Rogers-Pell Act was designed and our hope that you will find a way to influence resumption of its much-needed and well-deserved growth. We believe that this program, which seems to have drawn universal approbation, should take its rightful place among the Federal funds going into marine technology and be given a larger share of the overall budget.

Thank you for your attention. I will be happy to answer any questions you might have if I can.

Senator PELL. Thank you very much, Dr. Atwood. I would like to particularly congratulate you on the caliber of the Advisory Panel and not only the caliber of the commitments and ability but their willingness to take on all the chores that go with being a member of the Panel, investigation of the various universities that are applicants, and coming to a meeting like this. I think you have a larger attendance than many other advisory panels.

Dr. ATWOOD. We do.

Senator PELL. It shows a great deal of thought going into these choices and I congratulate you on that and not only their quality and caliber.

In connection with the idea that you covered of where we meet international competition in 10 years, that might also tie into the thought of moving into a study of the international sea grant college program.

Dr. ATWOOD. I think they are closely related.

Senator PELL. That would be a close relationship. I'm delighted to see different approaches looking into the same problem.

Another thought here is that, as has been mentioned earlier, the Department of Agriculture does a remarkably effective job of keeping American farmers informed. On the other hand, we don't have a Department of Aquaculture. I believe the Department of Agriculture has a budget of some billions of dollars, half a dozen billions, and has a roster, I read somewhere once, of employees that are almost the number of farmers; maybe it was in 25 percent of the States. I'm not sure what the exact statistics were. So we have to bear in mind, I think we have 16 employees and a budget of, hopefully, of what we authorize, after the intermingling of views in the executive branch and I think you do a very effective job.

Now, in this regard

Dr. ATWOOD. Perhaps I should remark, too, that the Department of Agriculture has been doing this for more than a hundred years and sea grant has been at it for some 6.

Senator PELL. Right; and also we simply are not set up as a large enough agency to take on full responsibility in this regard. I hope we grow, and I hope we move in that direction.

Dr. ATWOOD. One of the very encouraging things is the possible cooperation with the Extension Service of the land grant colleges where some of the county agents can take on certain sea grant tasks as part of their job, even though they are in the regular agricultural Extension Service.

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Senator PELL. I think part of this problem is the raising up in national consideration the problems related to interspace and ocean space rather than our concern with so many other esoteric problems. In this regard, I am happy to say that the Department of State, we have succeeded in moving up at least the Senate version of the bill, bureau level, the Bureau for Oceans, International Environment, and Scientific Affairs, and there is a general tendency, I think, to move up in this regard.

I thank you very much, Dr. Atwood, indeed. I would ask that, without objection, I will place in the record at this point on behalf of Senator Javits of New York an article that appeared in the New York Times on March 26, 1973, concerning the sea grant program as it applies in New York.

[The article follows:]

[From the New York Times, Mar. 26, 1973]

SEA-GRANT RESEARCH PROGRAM GIVES STATE ADVICE ABOUT MARINE RESOURCES

(By Harold Faber)

ALBANY, March 10.—New York State neglected its coastal resources for so long, a recent study said, that its waterways fell "into evil ways as depositories for the refuse of an otherwise lusty economy."

But the tide has now turned, according to Dr. Donald F. Squires, director of New York's new "sea grant program."

In operation for a little more than a year now, the program is devoted to research and advice about the marine resources of the state, whose coastline totals 2,433 miles.

Sitting in his office on the 13th floor of an Albany building, about 125 nautical miles from the sea, Dr. Squires pointed out the other day that New York was unique among the nation's 28 coastal states in that it had two coastlines—one on the Atlantic and the other on the Great Lakes.

The fresh water Great Lakes coast is 583 miles long and the coastline of southeastern New York, which includes all of the numerous bays and estuaries on Long Island, Westchester and the Bronx, as well as part of the Hudson River banks up to the head of its tidal waters near Albany, totals 1,850 miles.

New York sea grant program is part of a national marine development mechanism established by Congress in 1966 with the passage of the Sea Grant Act and in 1972 with the passage of the Coastal Zone Management Act. The aim was to develop long-range programs in marine science in the states bordering on the oceans or the Great Lakes.

More than 100 years after the Morrill Act of 1862 fostered the development of land grant colleges, with emphasis on agricultural research and advice to farmers sea grant colleges were authorized to do research to the nation's marine waters and to provide a marine advisory system.

New York, the only state with a double coastline, is also the only state with a combination of two colleges operating its sea grant program—the State University of New York and Cornell University, which is the state's only land-grant college.

But the joint venture, in operation for a year or so, is not yet a Sea Grant College because that designation can be bestowed only after three years. So far, six institutions have been so designated—the Universities of Washington, Rhode Island, Hawaii and Wisconsin, Oregon State University and Texas A&M.

But for all practical purposes, the combine of the State University and Cornell operates like a Sea Grant College, with two main spheres of activity—research and advice. It has a budget of $15-million (two-thirds of it from the Federal Government and one-third from state, local and industry sources) and 110 faculty members, 40 graduate students and perhaps 50 undergraduates involved.

This year, researchers are investigating power plant sites on Lake Ontario, the utilization of thermal discharges into water, the impact of discharges of Lake Erie on its bluffs, land values, taxes and employment in the area, the redevelopment of wetlands on Long Island, new uses for marine woods, fishery management, the

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impact of Coho salmon on New York fishermen, new uses of clam byproducts, erosion and the potential of the fish concentrate industry in the state.

In addition, several conferences have been held under the program, including one on marinas along the lakes, where the bankruptcy rate among operators is high because of the seasonal nature of their business; another on wetlands, trying to show local communities that they can protect their wetlands without waiting for new legislation, and one on coastal zone management, discussing who owns and regulates those areas.

The program has also set up regional marine advisory service offices, one at Brockport on the Great Lakes, one at Stony Brook for Long Island, and one at Ithaca to coordinate its efforts with the cooperative extension headquarters at Cornell's College of Agriculture and Life Sciences.

The marine advisory service is modeled after the Extension Service, the grass-roots mechanism by which research reports and advice are funneled to the state's farmers. The new service is already answering questions from the state's commercial fishermen and those concerned with recreation and environment, and it plans to expand its services to fish stores, restaurants and housewives.

"Nobody knows how to cook fish any more," Dr. Squires said. "And there's nobody in the supermarkets to tell them how."

Senator PELL. Our final witness this morning is Dr. John A. Knauss, provost of the University of Rhode Island, who has worked very closely with this Senator in the development of this whole program and to whom I am very grateful for many ideas.

STATEMENT OF DR. JOHN A. KNAUSS, PROVOST FOR MARINE AFFAIRS, UNIVERSITY OF RHODE ISLAND, KINGSTON, R.I.

Dr. KNAUSS. Thank you, Mr. Chairman. As you know, I have been involved with sea grant from the beginning, having organized the first sea grant conference in Newport, R.I., in 1965. I directed the sea grant program at the University of Rhode Island from its inception until 2 years ago. Our program was one of the original four to earn the accolade sea grant college. I was the first president of the Association of Sea Grant Program Institutions and at present serve as the secretary of that organization. Although I am no longer director of the URI program, it is one of the marine programs I am responsible for as provost for marine affairs at URI. Although I am speaking for myself at this hearing, I know my views are shared by many of my sea grant colleagues.

I would like to briefly address myself to four points. The first concerns a subject discussed by Dr. Atwood: namely, the success of sea grant. In my view, and in the views of my colleagues, sea grant has succeeded beyond all of our expectations. As individuals and institutions, we have occasionally stubbed our toes, run down a blind alley or two, and otherwise done things which hindsight suggests we could have done better. However, I think we have confounded our early critics, made believers of most skeptics, and built a constituency in the marine community I would not have believed possible 7 years ago.

Sea grant is a blend of pure and applied science and technology, coupled with extension and public service activities. In many programs across the country, this mix is working very well indeed. We are solving important problems and we are getting solutions out to the public where they are needed.

In Rhode Island, for example—and I use it because I know the program better than others—our sea grant work with the fishing industry ranges from business management assistance to design and on vessel testing of more efficient fishing gear. Similar broad range is found in

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other areas. Work on Narragansett Bay covers sophisticated scientific and computer analyses as well as direct work with Rhode Island's Coastal Management Council, with marine owners, and with other businesses dependent on the bay. Films and teachers' guidebooks on the marine environment are being produced for use in elementary and secondary schools.

A most recent example, we are involved in an analysis for Governor Noel of the economic impact of the impending Navy base closings. In other words, sea grant work is relevant.

In 1966, sea grant anticipated this move toward relevancy. It is a prototype for the much larger and broader program, NSF's research applied to national needs (RANN), which is presently going through early growth pains similar to those we experienced in sea grant.

All who have participated in sea grant can take some pride in its success. I am confident that sea grant will continue to fulfill its promise in the future.

And I'd like, Mr. Chairman, at this time to pay tribute to Bob Abel, who has provided inspired leadership from the beginning. If there is any single man who deserves credit for the present scope and shape of the sea grant program it is he.

My second point I wish to make concerns funding. Based on my knowledge of what is happening around the country I am confident that sea grant can wisely spend the funds authorized in S. 1262. In fact, the authorization figures are minimal for two principal reasons.

First, the existing sea grant colleges and institutional programs need better support. They are the foundations on which rests the potential of the Federal-State partnership in accomplishing sea grant's goals, which I would call enhancing our use of coastal waters and lands while protecting that very environment for future generations. Also, the research and development necessary to support wise decisions about those coastal resources need to be geared to the future as well as the present. This requires long-term funding commitments and are now in danger.

Second, the sea grant program needs to be expanded into all our marine and Great Lakes regions. These new programs need long-term support for research, education, and advisory services.

If the sea grant program is not able to give long-term support the program will not attract our most talented scientists and engineers. Furthermore, start-and-stop funding will almost certainly lead to planning and development errors in our coastal areas.

The true funding situation at sea grant institutions is not good at this time. The budget actions that froze certain fiscal year 1973 sea grant funds and provided no increase in fiscal year 1974 have had a traumatic effect on the program. I realize that sea grant is not the only program that has been badly hurt, and I have no intention to engage in special pleading but I think you should know the effect is not as severe as can generally recognized.

For example, the January 27, 1973, message from the Administrator of NOAA spelled out the effects of the President's action on all of NOAA's programs. The statement on sea grant was as follows: "The sea grant program will go forward at a rate slightly increased over that in the past. The rate, however, will be below that appropriated by the Congress."

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The facts of the matter are somewhat different. Sea grant has traditionally funded many programs on 2 year grants. It also has encouraged, and thought it had reason to encourage, rising expectations in terms of building new programs. Although I don't understand in detail all of the reasons for what happened, the effect has been a reduction, not a slight increase, in most if not all of the sea grant projects.

For the University of Rhode Island, it has meant a reduction from a fiscal year 1973 funding level of $1.2 million to a level of $935,000, a 22-percent decrease. I wish to point out that our reduction is not nearly as drastic as many others. In fact, we take some small comfort in the fact that we have faired relatively well. However, this reduction, coupled with an increase of more than 9 percent in the cost of doing business at URI, means that we are talking about an effective loss of more than 31 percent of our program this next year. We have reduced the number of people employed by sea grant by 27 percent and this includes support for 18 graduate students.

What is happening at URI is similar to what is happening across the country and, again, I wish to emphasize that the problems elsewhere are in many cases more severe. As an original participant in sea grant we have developed some continuity. We have not yet suffered a loss of morale and enthusiasm. We have not yet had key personnel tell us they want to wash their hands of sea grant because it has no future. We have not had the university administration nor the State legislature question us concerning the Federal Government's apparent breach in faith concerning a matching program that requires considerable financial sacrifice. It is my understanding this has occurred elsewhere.

I don't think Congress should be led to believe that we are going forward at a rate slightly increased over that in the past. We are not. At a time when Congress has passed coastal zone management legislation, unfortunately unfunded; at a time when our interest and involvement in marine activities is increasing in many directions, from a forthcoming law of the sea conference, to increased concern for our coastal fisheries, to the development of offshore ports, offshore nuclear powerplants, and an increase in offshore oil exploitation; it seems to this sea grant enthusiast that the administration is taking a very short-term look to the future when it causes an actual reduction in sea grant activities.

My third point concerns ship support. Sea grant funds are not allowed to support research vessels. It is my understanding that this original restriction was based on two reasons. Sea grant was originally in the National Science Foundation and NSF received research vessel support as a separate budgeting item. Furthermore, there was some concern before the program took shape that sea grant funds might be used to enhance other ocean programs.

I would like to suggest a modification to the present restriction. Sea grant activities require the services of a number of small coastal vessels. NSF is taking an increasingly parochial attitude about research vessel support. As it finds its own funds limited it is taking the not unnatural attitude that NSF sponsored research has first priority. This suggests that work done from small coastal vessels for Federal programs such as NOAA, AEC, EPA, and so forth, be supported by those agencies.

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Thus, I would like to suggest that sea grant also should be expected to pay its own way for work done from coastal research vessels. Although I have no specific wording in mind, perhaps the act could be amended so that the restriction on sea grant funds for ship support would apply only to vessels in excess of some length, say 85 feet. I believe little sea grant research is conducted on larger vessels. I know we do almost no sea grant research on our larger research vessel, [illegible], and I believe that to be true at other oceanographic institutions as well. We, and others, use a number of small vessels in our sea grant activities; and it does seem to me that sea grant should be expected to pay its fair share of the support of these vessels.

My final point, Mr. Chairman, concerns the new section 205 of S. 1268, "Study of international marine technology transfer." It has my enthusiastic support. I only wish I felt sufficiently confident to suggest the section does not go far enough. It may be, in fact, that the $, 500,000 is too small a sum; I think more could be usefully spent. However, I am satisfied at this stage in our activities that we should authorize a study rather than authorize sea grant to move into active support of such programs. It may be sea grant is not well suited for this type of activity.

However, from my limited understanding of the nature of the problem I think sea grant will provide an ideal mechanism for effecting information and technology transfer to nations of the developing world. But whether it is or is not, I believe that the problem is of sufficient importance for sea grant to undertake such a study.

Let me indicate why I think it is important. I have been privileged to serve as a participant and adviser with the U.S. delegation in the U.N.-sponsored preparatory meetings leading to the forthcoming Law of the Sea Conference. I think it is safe to forecast that as a result of the Conference a coastal nation will gain more management control of its nearshore coastal resources, will participate actively in the management of resources of the deep seabed, and will be an active participant in resolving problems relating to marine pollution.

The nations of the developing world have indicated that they want help from the developed world, and the United States in the person of Ambassador McKernan made a commitment to that effect on August 14, 1972, before the nations of the U.N. Seabed Committee. In addition, the first NACOA report to the President and Congress suggested that sea grant would be a desirable vehicle for such an effort.

The first chapter of its report is entitled, "Some International Issues Related to Law of the Sea." In that chapter one finds the following statement:

"One principal recommendation is to engage other countries, particularly the developing nations, in as many joint projects with the United States as possible and in as great a variety as reasonable."

And further along it says, and I'll only read part of this:

"Thus, a new candidate for international programs is the United States sea grant program. By analogy with our land grant program it offers great promise. One of the great contributions of the land grant concept to the common welfare has been that of American agricultural technology, and the key element has been the educational contribution of our great agricultural colleges and universities. Their dedicated students are to be found in the most remote corners of the

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world. They have been instrumental in helping feed the world's billions by introducing new agricultural and land management practices. We cannot properly compare the fledgling sea grant program of the Department of Commerce with the land grant program activity developed over the past century, but the potential is there."

No one is suggesting that sea grant alone can resolve the fundamental problem of the widening technological and income gap between the developed and developing world. What many of us hope, however, is that sea grant can make an important contribution to this problem at a time when the nature of man's use of the ocean is changing.

I thank you.

Senator Pell. Thank you very much, Dr. Knauss, for an excellent, very stimulating statement. A couple of points in connection with it.

One, where you mention that, "We have not had the university administration nor the State legislature question us concerning the Federal Government's apparent breach in faith concerning a matching program that requires considerable financial sacrifice. It is my understanding this has occurred elsewhere."

As a member of the advisory panel I understand you have an overall view of the situation and I was wondering if you could indicate to us what other institutions are involved here.

Dr. Knauss. Although I am involved in Sea Grant Association, I am not a member of Dr. Abel's advisory panel. My information is entirely secondhand. I believe Dr. Abel or others could provide more specific information. I have been told that in some States where they have just gotten started on their sea grant program and were looking forward to an expansion and where the States themselves had made a considerable sacrifice there have been questions concerning what has happened to all this potential. In States such as South Carolina, Mississippi, and Alabama, there have been some questions asked as to whether or not sea grant really is worth all the effort that the universities and the States have put into it. I'm sure that our association can provide documentation on this for you and perhaps Dr. Abel can also provide such documentation.

Senator Pell. Right. We would appreciate it. That comes down on another point here. Also, what is at stake here is the good faith of the Federal Government, which when I was many years ago whatever was said by the Federal Government was automatically plans made were automatically believed were as good as gold and now we find a somewhat different situation and I think with all the problems of the Watergate and the problems of the good faith of government in the last few years have had an eroding effect that has been bad for the country, for that is getting off the

Dr. Knauss. I don't mean to imply in any way there was any kind of formal promise made by sea grant.

Senator Pell. No.

Dr. Knauss. I just think people were led to believe these programs were going forward.

Senator Pell. Yes. Now, you mentioned in connection with the Law of the Sea Conference that there may be an active participation related to marine pollution. I don't think they will get into that too much, will they? That would be more the IMCO group.

Dr. Knauss. I wouldn't care to bet on it, sir.

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Senator PELL. Yes, particularly since we will be there again participating.

I would like to get the reaction of Dr. Abel to the suggestion with regard to the funding for research vessels of 85 feet or less. What would be your reaction in authorizing legislation in that regard?

Dr. ABEL. Well, of course, at the moment, Mr. Chairman, the problem is somewhat academic because we would not have the funds to support the use of these vessels at the present time. Over the longer period, as we have evaluated the program in retrospect, in most of sea grant oceanography in the classical sense is simply not the name of the game, and while it's true a number of our grantees have to use vessels by far the majority of them operate at home.

I would refer specifically to aquaculture projects, to projects relating to law and economics, to social sciences generally speaking. I have been advised on several instances by our grantees that they do feel that they are operating in somewhat of a parasitic mode in that they have to use these vessels without being allowed to pay for them. In some cases they are able to respond in kind and I am not able to go into details.

These are matters that take place internally in the university. In other instances, they are able to use the matching funds. Now, when the university or when a grantee generally has relatively unrestricted matching funds he is certainly able to use them for this purpose. The Pell-Rogers Act permits this, so that we come down to in summary, are those few grantees whose matching funds are limited and specified, who have more than the occasional use of ships built into their programs and who simply lack resources otherwise. In those cases where my best estimate might be perhaps $50,000 or $200,000, then I'd have to be sympathetic toward the desire to use the ships.

In the past, we have been able to get around it through as matters of goodwill. They have been able to use the good offices of other grantees of other institutions, of other Federal agencies in programs sponsored by the Navy or the National Science Foundation for instance, but as we [illegible], money is tightening up from all sources and I would have to [illegible] Dr. Krauss' statement that perhaps in a few [illegible] getting.

Senator PELL. [illegible] institution has their own acute problems and, Dr. [illegible] to me that with the Federal Government [illegible] other problems caused by other Federal [illegible] our States and new demands made upon [illegible] authorities, you are in a bit of a crunch here.

Dr. KRAUSS. [illegible] question. It is a much more exciting time to [illegible] than it used to be.

Senator PELL. Very good. Thank you very much indeed.

[The statement follows:]

STATEMENT OF DR. JOHN A. KNAUSS, UNIVERSITY OF RHODE ISLAND, KINGSTON, RHODE ISLAND

My association with Sea Grant has been practically [illegible] the beginning [illegible] of the first Sea Grant conference in Newport, Rhode Island in 1965. I was one of the Sea Grant Program at the University of Rhode Island [illegible] about two years ago. Our program was one of the original [illegible] to include Sea Grant College. I was the first president of the Association of Sea Grant Program Institutions and at present serve as the secretary of [illegible] organization. Although I am no longer director of the URI

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program it is one of the marine programs I am responsible for as provost for marine affairs at URI. Although I am speaking for myself at this hearing, I know my views are shared by many of my Sea Grant colleagues.

I would like briefly to address myself to four points. The first concerns the success of Sea Grant. In my view, and in the views of my colleagues, Sea Grant has succeeded beyond all of our expectations. As individuals and institutions, we have occasionally stubbed our toes, run down a blind alley, and otherwise done things which hindsight suggests we could have done better; however, we have confounded our early critics, made believers of most skeptics and built a consistency in the marine community that I would not have believed possible. Sea Grant is a blend of pure and applied science and technology, coupled with extension and public service activities. In many programs across the country, this mix is working very well indeed. We are solving important problems and we are getting solutions out to the public where they are needed.

In Rhode Island, for example, our Sea Grant work with the fishing industry ranges from business management assistance to design and on-vessel testing of more efficient fishing gear. "The county agent in hip boots" is a reality. Similar broad range is found in other areas. Work on Narragansett Bay covers sophisticated scientific and computer analyses as well as direct work with Rhode Island's Coastal Management Council, with marina owners and with other businesses dependent on the Bay. An analysis of the economic impact of the impending Navy closings is presently being written for Governor Noel's office. Films and teachers' guide books on the marine environment are being produced for use in elementary and secondary schools. Sea Grant work is relevant. In fact, in 1966 Sea Grant anticipated the move toward relevancy. It is a prototype for the much larger and broader program, NSF's Research Applied to National Needs (RANN) which is presently going through early growth pains similar to those we experienced in Sea Grant.

All who have participated in Sea Grant can take some pride in its success. I am confident that Sea Grant will continue to fulfill its promise in the future.

The second point I wish to make concerns funding. Based on my knowledge of what is happening around the country I am confident that Sea Grant can wisely spend the funds authorized in S. 1262. In fact, the authorization figures are conservative for two principal reasons.

First, the existing Sea Grant Colleges and Institutional Programs need better support. They are the foundations on which rests the potential of the federal-state partnership in accomplishing Sea Grant's goals enhancing our use of coastal waters and lands while protecting that very environment for future generations. Also, the research and development necessary to support wise decisions about these coastal resources need to be geared to the future as well as the present. This requires long term funding commitments that are now in danger.

Second, the Sea Grant Program needs to be expanded into all our marine and Great Lakes regions. They need long term support for research, education and advisory services.

If the Sea Grant Program is not able to give long term support the program will not attract our most talented scientists and engineers. Furthermore, the series of short term studies that will result will almost certainly lead to planning and development errors in our coastal areas.

The true funding situation at Sea Grant institutions is not good at this time. The budget actions that froze certain FY 73 Sea Grant funds and provided no increase in FY 74 have had a traumatic effect on the program. I realize that ours is not the only program that has been badly hurt, and I have no intention to engage in special pleading, but I think you should know the effect is much more severe than generally recognized. For example, the January 27, 1973, "Message from the Administrator" of NOAA spelled out the effects of the President's actions on all of NOAA's programs. The statement on Sea Grant was as follows: "The Sea Grant program will go forward at a rate slightly increased over that in the past. The rate, however, will be below that appropriated by the Congress." The facts of the matter are somewhat different. Sea Grant has traditionally funded many programs on two year grants. It also has encouraged, and thought it had reason to encourage, "rising expectations" in terms of building new programs. Although I don't understand in detail all of the reasons for what happened, the effect has been a reduction, *not* a slight increase in the Sea Grant effort. For the University of Rhode Island it has meant a reduction from a FY 73 funding level of 1.2 million dollars to a level of $935,000, a 22 percent decrease. I wish to point out that our reduction is not nearly as drastic as many others.

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In fact, we take some small comfort in the fact that we have fared relatively well. However, this reduction, coupled with an increase of more than nine percent in the cost of doing business at URI, means that we are talking about an effective loss of more than 31 percent of our program. We have reduced the number of people employed by Sea Grant by 25 percent and this includes support for 18 graduate students. What is happening at URI is similar to what is happening across the country, and again I wish to emphasize that the problems elsewhere are in many cases more severe. As an original participant in Sea Grant we have developed some continuity. We have not yet suffered a loss of morale and enthusiasm. We have not yet had key personnel tell us they want to wash their hands of Sea Grant because it has no future. We have not had the university administration nor the state legislature question us concerning the federal government's apparent breach in faith concerning a matching program that requires considerable financial sacrifice. It is my understanding this has occurred elsewhere.

I don't think Congress should be led to believe that we are going "forward at a rate slightly increased over that in the past." We are not. At a time when Congress has passed coastal zone management legislation, unfortunately unfunded; at a time when our interest and involvement in marine activities is increasing in many directions, from a forthcoming law of the sea conference, to increased concern for our coastal fisheries, to the development of offshore ports, offshore nuclear power plants, and an increase in offshore oil exploitation; it seems to this Sea Grant enthusiast that the Administration is taking a very short-term look to the future when it causes an actual reduction in the Sea Grant activities.

My third point concerns ship support. Sea Grant funds are not allowed to support research vessels. It is my understanding that this original restriction was based on two reasons. Sea Grant was originally in NSF and NSF received research vessel support as a separate budgeting item. Furthermore, there was some concern before the program took shape, that Sea Grant funds might be used to enhance other open ocean programs.

I would like to suggest a modification to the present restriction. Sea Grant activities require the services of a number of small coastal vessels. NSF is taking an increasingly parochial attitude about research vessel support. As it finds its own funds limited it is taking the not unnatural attitude that NSF-supported research has first priority. This suggests that work done from small coastal vessels for federal programs such as NOAA, AEC, EPA, etc., be supported by those agencies. Thus, I would like to suggest that Sea Grant also should be expected to pay its own way for work done from coastal research vessels. Although I have no specific wording in mind, perhaps the act could be amended so that the restriction on Sea Grant funds for ship support would apply only to vessels in excess of some length, say 85 feet. I believe little Sea Grant research is conducted on larger vessels. I know we do almost no Sea Grant research on our larger research vessel TRIDENT and I believe that to be true of other ocean, graphic institutions; but we, and others, use a number of small vessels in our Sea Grant activities; and it does seem to me that Sea Grant should be expected to pay its fair share of the support of these vessels.

My final point concerns the new Section 205, "study of international marine technology transfer." It has my enthusiastic support. I only wish I felt sufficiently confident to suggest the section does not go far enough. It may be, in fact, that the $100,000 is too small a sum; I think more could be usefully spent. However, I am satisfied at this stage in our activities that we should settle on a "study" rather than authorize Sea Grant to move into active support of such programs. It may be Sea Grant is not well suited for this type of activity. However, from my limited understanding of the nature of the problem I think Sea Grant will provide an ideal mechanism for effecting information and technology transfer to nations of the developing world. But whether it is or is not, I believe that the problem is of sufficient importance for Sea Grant to undertake such a study.

Let me say a few words about why I think it is important. I have been privileged to serve as a participant and adviser with the U.S. Delegation in the U.N.-sponsored preparatory meetings leading to the forthcoming law of the sea conference. I think it is safe to forecast that as a result of this conference a coastal nation will gain more management control of its geo, shore coastal resources, will participate actively in the management of resources of the deep seabed, and will be an active participant in resolving problems relating to marine pollution. The nations of the developing world have indicated they want help from the developed world, and the U.S. in the person of Ambassador McKernan made a commitment to that

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effect in August 11, 1972, before the nations of the U.S. Seabed Committee. In addition, the first NACOA report to the President and Congress suggested that Sea Grant would be a desirable vehicle for such an effort. The first chapter of its report is entitled, "Some International Issues Related to Law of the Sea." In that chapter one finds the following italicized statement.

"Our principal recommendation is to engage other countries, particularly the developing nations, in as many joint projects with the United States as possible and in as great a variety as reasonable."

Further along it says.

Thus, a new candidate for international programs is the United States Sea Grant Program. By analogy with our Land Grant Program it offers great promise. One of the great contributions of the Land Grant Program to the common welfare has been that of American agricultural technology, and the key element has been the educational contribution of our great agricultural colleges and universities. Their dedicated students are to be found in the most remote corners of the world. They have been instrumental in helping feed the world's billions by introducing new agricultural and land management practices. We cannot properly compare the fledgling Sea Grant Program of the Department of Commerce with the Land Grant Program activity developed over the past century, but the potential is there. One possibility has already been noted. The Sea Grant Program could be made even more valuable than at present by introducing an exchange program for foreign students, particularly from the developing countries."

No one is suggesting that Sea Grant alone can resolve the fundamental problem of the widening technological and income gap between the developed and developing world. What many of us hope, however, is that Sea Grant can make an important contribution to this problem at a time when the nature of man's use of the ocean is changing.

Senator Pell. This concludes this hearing. I thank the witnesses for being here and thank particularly the Panel for spending so much of their time with us this morning.

The record will be left open for at least a week for any further statements that may come in and the joint hearing is adjourned.

[Whereupon, at 12:38 p.m., the hearing was adjourned.]

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ADDITIONAL ARTICLES, LETTERS, AND STATEMENTS

U.S. SENATE,
Washington, D.C., May 30, 197..

Hon. ERNEST F. HOLLINGS,
Chairman, Subcommittee on Oceans and Atmosphere, Commerce Committee, Washington, D.C.

DEAR FRITZ: I strongly support the continuation of the Sea Grant College Program at a funding level of $30,000,000 for FY74, $40,000,000 for FY75 and $50,000,000 for FY76.

California has benefited greatly from the Sea Grant College. The University of California Sea Grant Program is the second largest recipient of Sea Grant funds.

Planning for wise use of the coastal zone is a national problem of immediate concern to states that border the ocean. The people of the State of California passed the California Coastal Zone Conservation Act of 1972 to protect their coastal wealth. Recognizing the need that land-use planners have for information on the coastal zone, the UC Sea Grant Program concentrates research on ecological studies, studies on the physical processes operating in the near-shore zone, and the development of decision making models for better resource use.

Tapping the biological resources of the ocean is another area of UC Sea Grant research. Major emphasis this past year has been on aquaculture of such edible marine life as seaweed, lobsters, and abalone. At the same time the UC program has conducted research to help established fisheries and the seafood industry in general.

Sea Grant engineers are finding new ways of protecting coastal installations and carrying on useful work in the sea that minimizes environmental disruption.

Sea Grant research programs are expected to apply research results to the solution of problems related to marine resources and to be responsive to the needs of the community in which they operate. To preserve a proper perspective between local and national needs, the University of California Sea Grant Program undertakes local service research and strives to solve local problems when the answers may have a broad regional, national, or global application.

The California program is administered by the University of California Institute of Marine Resources (IMR) at the UC, San Diego, campus. Local administrative centers are located in the IMR branch office at UC, Davis, at the Institute of Marine Science at UC, Santa Barbara, and at the Bureau of Marine Science of California State University, San Diego (formerly San Diego State College). Sea Grant research activities are carried out on these four campuses, as well as on the UC campuses at Santa Cruz, Berkeley, Los Angeles, and Riverside. Policy guidance is provided by the Sea Grant Coordinating Council, appointed by the President of the University of California, consisting of university and public members.

Within the broad field of applied work on marine resources in the Sea Grant Act, each Sea Grant institution chooses the area of emphasis that best suit its capabilities and the needs of its local area. Within the program of the past year, they have given principal emphasis to the problems of the California coastal zone and to the development of new aquacultural industries.

They have also initiated a marine advisory service, which they hope in coming years will employ the results of these researches to provide advice and assistance to all of those in California who earn their living from the sea or deal with the effects of the sea on man and man on the sea.

The University of California Sea Grant program began in 1968 as a program to develop a new graduate curriculum in applied ocean science on the UC, San Diego campus. In subsequent years a pilot program for developing a curriculum in applied biomedicine and a program to train instructors in scientific diving were added at UCSD. A marine technician training program was initiated as a joint effort of UCSD and California State University, San Diego.

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A program of Sea Grant Traineeships provides research experience and support of thesis projects for graduate students working on applied topics related to ocean resources. During the past year, the Sea Grant Traineeship program, begun at UCSD, was extended to the UC campuses at Berkeley (5 students), Davis (6 students), Santa Cruz (2 students) and Santa Barbara (3 students). UC San Diego, has 23 Sea Grant student trainees. Because educational programs involving doctorate candidates develop slowly, the thesis projects reported on in this section are all from the established UCSD program.

Getting research results to the public is also one of Sea Grant's educational goals. For many years the Thomas Wayland Vaughn Aquarium-Museum at Scripps Institution of Oceanography, UC, San Diego has done this with both public exhibits and educational programs for a limited number of local school groups. The Sea Grant program has assisted the Aquarium-Museum in enlarging its educational program to reach more students.

By the term "advisory services", Sea Grant means the variety of methods used to communicate research results and other specialized knowledge to those in the community who will apply the information in properly utilizing marine resources or managing the marine environment. Information dissemination channels may include the mass media, technical and popular publications, conferences, seminars and demonstrations and personalized contacts.

Major emphasis of the University of California advisory services program has been to set up marine information channels through an already existing statewide network of county agricultural extension offices. These offices are staffed with university specialists who not only relay research results to the community but also carry user needs back to educators as guidelines for future studies.

While this new combined effort of agricultural and marine sciences is being organized into "Cooperative Extension", other advisory service projects operate separately. There is a project for disseminating advice on handling and processing edible marine products, a project to supply southern California small boat operators with weather and sea conditions information and a geologic Sea Grant Program began setting up its advisory services this year, research results and agency program activities were not taken to consumers in an organized program. The user who needed information had to try to find it among the diverse and often uncommunicative offices and staffs of the universities and government.

By briefly outlining the scale of and the benefits to be derived from just one program in one of the 50 states, we can see how vital this program is. This is again illustrated if we magnify that by the many states involved keeping in mind that all of us, whether participants or not, are the recipients of the positive effects of the Sea Grant College.

All of us are aware that the ocean covers 71% of the earth's surface. It is a last frontier, perhaps the vital link in continuing our civilization. Oceans provide a great deal of our food supply already and will undoubtedly bear an even greater share of the burden of feeding the world in the future. Oceans harbor hidden wealth in the form of gas, oil and minerals. Oceans also provide a great source of recreation. We must find a way to utilize the oceans without destroying them. The Sea Grant College is an important step toward that goal.

Sincerely,

JOHN V. TUNNEY,
U.S. Senator.

STATEMENT OF DR. JOHN M. ARMSTRONG, DIRECTOR, GREAT LAKES RESOURCE MANAGEMENT PROGRAM OF THE UNIVERSITY OF MICHIGAN, TO THE UNIVERSITY OF MICHIGAN SEA GRANT PROGRAM

The Michigan Sea Grant Program is committed to an objective of applied research and public service in the Great Lakes region that is unique in the history of the University of Michigan.

Our Sea Grant program is centered around the concept of problem-related research, in conjunction with state, regional and local agencies of government and with private citizen groups and industry. This research is focused on environmental quality and resource management problems of the Great Lakes and its coastal areas.

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The Michigan Sea Grant Program involves over 100 faculty and staff that represent every major school or college in the University, and includes the disciplines of biology, zoology, medicine, political science, science, law, engineering, sociology, economics, urban planning, and oceanography.

A major activity in the program is the establishment of cooperative projects with state and local agencies on current and expected future problems of these types. Examples of this approach are the following:

1. A study of the recreational impact of the sports fishery in Grand Traverse Bay in Northwest Lower Michigan. This study was carried out with the fish division of the Michigan Department of Natural Resources and provided valuable insight to the important role of the sports fishery in that region.

2. An ongoing study of the impact of thermal discharge from nuclear power plants on Michigan shorelands in cooperation with the Michigan Department of Agriculture and the power industry. This is a critical issue in the Great Lakes and elsewhere.

3. An assistance program with the Michigan Department of Natural Resources to provide information for the Michigan shoreland management plan recently published by the Department of Natural Resources. This plan is a major step forward to protect wise use of Michigan's invaluable shoreland resources.

4. A public information program in the Grand Traverse Bay region where Sea Grant researchers are working directly with local planners on pressing problems relating to wastewater treatment, urban growth, shoreland preservation and fishery development.

5. An assistance program with the city of Chicago in preparing a comprehensive research program to ensure the environmental compatibility of the proposed offshore island recreational system on the Chicago lakefront.

6. An information and assistance program in conjunction with the Michigan Sport Fishing Association and the fishing tackle industry in developing better approaches to the problem of sport fishing development in the Great Lakes.

7. A cooperative research program with the Michigan Department of Natural Resources in developing a management model of the salmon fishery in Lake Michigan to improve the yield and catch levels in this economically important fishery.

8. A cooperative demonstration project with the Water Resources Commission to investigate the feasibility of several shore erosion protection devices that could be used to help solve Michigan's urgent shore erosion problems.

9. Conducting a technology demonstration project to assist industry and municipalities in the region to meet the requirements of the 1972 Clean Water Amendments for best available technology.

10. Initiated a program in conjunction with the Michigan Water Resources Commission to determine the various approaches to be taken in improving the water quality of Saginaw Bay on Lake Huron.

These are only some of the several research activities the Michigan Sea Grant program is engaged in.

The innovative approach and impact of this program is found throughout our State and the Great Lakes region and goes beyond original expectations. The program has succeeded in utilizing the extensive reservoir of academic talent at the University in tackling resource problems of priority interest to a variety of resource users and managers.

Recognition of the importance of the Sea Grant program was expressed recently by Governor Milliken in designating our Sea Grant program as the "state's coastal zone laboratory"—a designation that opens the way for increased participation of University and state researchers on the total problem of managing Michigan's coastal system.

The program has served as a catalyst for bringing to bear the multidisciplinary resources of the University on real and important Great Lakes issues.

The program is faced this coming fiscal year with what amounts to a catastrophic cut in Federal support. The current level of funding from the National Oceanic and Atmospheric Administration is $950,000. The budget figure indicated by NOAA for next year is $507,000—a 40 percent cut from current level. This drastic cut comes at a time when our Sea Grant program has attained a critical momentum in terms of reaching out to the Great Lakes community. In addition to a general crippling of our interdisciplinary team of researchers these cuts will essentially eliminate our efforts in

Erosion protection studies.
Wastewater treatment technology demonstration.
Thermal discharge impact studies.

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It will severely cut back our Traverse Bay advisory program in Grand Traverse Bay. This comes at a time when we have built up a high level of confidence and commitment in University participation in community problems. The budget cut will reduce our Saginaw Bay Water Quality Management Alternatives Program to almost a token effort in comparison to what was planned with state and local officials.

In addition, every one of our remaining individual projects will suffer substantial cutbacks—some in research activities where the usefulness of previously gathered information and study will be negated considerably. The budget reduction proposed for the coming fiscal year comes at the most inopportune time possible in light of the efforts made to create this important program.

It is my sincere hope that Congress will find the means to restore these funds and to ensure they are made available.

Senator HART: The following has been prepared in response to a telephone call by John Hussey relative to the University of Michigan Sea Grant program.

Question 1. How is the Sea Grant administered and what are the practical results of designating a college as such?

Answer: Three categories of support are available for the conduct of Sea Grant activities: Institutional, Coherent Project, and Project. Sea Grant Institutional Support is awarded to an institution of higher education which has an existing broad base of competence in marine affairs. To qualify, the institution must make a positive, long-range commitment to marine affairs as evidenced by the university's own commitment of resources in the form of matching funds, creation of the organization necessary for management of the Sea Grant program, establishment of interdisciplinary research teams, and development of advisory services mechanism for strong interaction with marine communities in its region.

Sea Grant Colleges are designated from among institutions of higher education receiving Institutional Support. The designation is based on quality, quantity, and productivity of performance in the categories of research, education, and advisory services; the degree and nature of cooperation with and services to its marine communities; the exercise of leadership in the institutions region over a period of not less than three years under institutional support; and the efficiency and competence of its Sea Grant program management.

The designation of a Sea Grant College symbolizes a mutual recognition of continuing responsibility, both by the Department of Commerce and the institution so designated, to develop and maintain the excellence and public utility of the institution's Sea Grant program.

By the award of Sea Grant College status, the Department of Commerce expresses its confidence in the demonstrated dedication and competence of the Sea Grant College by assigning priority of support to the College, within the limits of overall Federal priority and fiscal considerations, renewable as continued performance by the College may warrant.

The Sea Grant College accepts with such designation the responsibility for the continued pursuant of excellence in marine research, education, and public service through advisory programs, and the exercise of leadership in its region in assisting and supporting other institutions and agencies, both public and private, in the development of programs for the proper use and protection of the marine environment.

Question 2: How many colleges are now eligible for consideration, and what is the rationale for the present position that no new designations will be made?

Answer. Six universities have already been designated as Sea Grant Colleges. They are the University of Rhode Island, Texas A&M University, Oregon State University, University of Hawaii, University of Washington, and the University of Wisconsin. Five other universities have completed the minimum three years requirement for consideration as Sea Grant Colleges: University of California, University of Miami, University of Southern California, University of North Carolina, and the University of Michigan. There is no new established position concerning new designations. It is likely, however that contenders for the Sea Grant College designation will find it much more difficult to meet the criteria for Sea Grant College designation under a diminishing budget rather than an expanding one.

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Question 3: Specifically, is the University of Michigan now eligible for such consideration, and if no budgetary constraints were incurred, does a program meet the other criteria for designation?

Answer. As mentioned above, the University of Michigan has been in the Sea Grant institutional support program the required minimum of three years. However, designation as a Sea Grant College is anything but automatic after the prescribed period. It is, rather, a matter of the most serious consideration by the Department of Commerce and its advisory panel, following definitive review of the program by the panel, the staff, and outside experts. It is not possible to entirely separate the impact of budgetary constraints on the quality and quantity of the broad spectrum of activities a university must pursue under the criteria. Previous Sea Grant College designations were made during years of program growth when we were able to provide the universities the necessary resources to get positively to critical program reviews by establishing high quality activities required under the criteria for designation. During the last year, all Sea Grant programs, including Michigan's, have had to face severe reductions irrespective of their quality, although quality certainly was a mitigating factor. So while the most recent review did not indicate Michigan had met all criteria, one can appreciate the difficulty experienced by an institution in trying to meet Sea Grant College criteria in the present funding climate.

Question 4: In making budget cut recommendations, what criteria if any were followed by OMB?

Answer. If there were any criteria followed by OMB in making budget cut recommendations, they were not provided to us.

A copy of Guidelines and Background for Sea Grant College Designation is provided as amplification on the remarks above.

Attachment.

GUIDELINES AND BACKGROUNDS FOR SEA GRANT COLLEGE DESIGNATION

1. Eligibility

To be eligible for consideration as a Sea Grant College, an institution must have been under Sea Grant institutional support for at least three years. Further, under the terms of Public Law 89-688, the National Sea Grant College and Program Act, the institution must be a "suitable public or private institution of higher education."

2. Criteria

The eligible institution is evaluated by a site visit team composed of members of the Sea Grant Advisory Panel, the Sea Grant staff, and other experts. While the judgments of the reviewers must be to some degree subjective, the institution must receive high marks in all of the following categories:

Leadership. The institution must have achieved recognition as an intellectual and practical leader in marine science, engineering, education and public service in its state and region.

Organization. The institution must have created the management organization to carry on a viable and productive multidisciplinary Sea Grant Program, and the organization must have the backing of the institution's administration.

Relevance. The institution's Sea Grant Program must be directly relevant to local, state, regional, or national opportunities and problems in the marine environment.

Programmed Team Approach. The need for relevance also dictates a need for programming research activities so that an end product can be achieved in a reasonable time. The nature of marine problems is such that few are susceptible to solution by individual disciplines; it is inherent in the Sea Grant philosophy that all pertinent disciplines should be applied to a given problem or opportunity. Consequently, as applicable, the research approach of the university must be programmed to obtain results, and conducted by teams of a multidisciplinary nature. These requirements are in addition to the fundamental requirement of high quality and scientific and engineering validity of the research, including social and economic validity.

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Education and training. Education and training must be clearly relevant to both national and regional needs for manpower, must be of high quality, and must be so programmed that graduates have a high probability of obtaining employment. As appropriate, emphasis may be on engineering education, social science or legal education, or two-year technician training in cooperation with two-year schools.

Advisory Services. Because the essence of Sea Grant is development and utilization of useful information, the institution must have a strong program through which the results of research may be communicated to user communities.

Relationships. If the Sea Grant institution is to serve its state, region, and the nation effectively, it must have close ties with Federal agencies, state agencies and administrations, local authorities, business and industry, and other educational institutions. These ties are to ensure the relevance of its programs, to generate requests for such assistance as the institution may offer, and to assist others in developing research and management competence. The extent and quality of an institution's relationships are therefore a critical factor in evaluating the institutional program.

Productivity. The institution must have demonstrated the degree of productivity of research results, reports, employed students, service to state agencies and industry, etc.) commensurate with the length of its Sea Grant operations and the level of funding under which it has worked.

Support. Sea Grant requires that its funds be matched with one non-Federal dollar for every two Federal dollars. One measure of the strength of an institutional program is its ability to obtain matching funds from non-Federal sources. Such sources include state legislatures, the university management, state agencies, and business and industry. While there are major variations in the institutional structures of the several states and in the size and nature of state business and industry, some credit must be given to institutions which have obtained matching funds through the participation of their states, and local or regional industries. In all cases, the legal matching requirement must have been met.

3. The Rewards of Sea Grant College Designation

The principal intangible value of Sea Grant College designation to a university is prestige within its state and within the research community.

The principal tangible value is the assignment of priority within the Sea Grant plan and "within the limits of overall Federal priority and fiscal considerations, renewable as continued performance by the College may warrant." In fact, this priority does not give very much that is new. The quality of work in a Sea Grant institution must be at least equal to the work proposed under short-term Sea Grant projects, and when faced with limited funds and proposals of equal merit, one from an existing Sea Grant institution and one from another source, the institution receives priority even now. The designation of Sea Grant College will not alter in any way the Sea Grant control of program content and quality exercised through the multiple review process, and the best projects will be funded whether they are part of a Sea Grant College proposal or are submitted by some other institution. This is not only acceptable to the Sea Grant institutions; it is expected. The designation nevertheless does have positive value because it is a symbol of continuity of funding, a reassurance that senior scientists in the university, or state legislators faced with matching funds appropriations, are placing their faith in a long-term investment.

A major tangible reward is that the expression of faith in the institution symbolized by Sea Grant College designation is accompanied by agreement that the College can present two-year proposals, and be given full-scale site visit reviews every other year. Because preparation of the voluminous proposals is very time consuming and difficult, and the review process frequently traumatic, this easing of requirements is very important. The College will still be visited at least once a year by staff and perhaps an outside expert or two, but such visits are less formal, do not require intensive preparation by the college, and are more for information on progress and procedures than intensive review with funding or refusal of funding to be the result.